Engineering Library
JAN 17 1922

Electrical World

McGraw-Hill Company, Inc. New York, January 14, 1922 Twenty-five Cents a Copy

For Single and Polyphase Motors

Across-the-line starter of the thermal limit type. It furnishes low-voltage and over-load protection, prevents single-phase running, gives full-voltage, full-current and full-torque start, and provides remote control from push stations.

Bulletin 1011 gives full description. Send for it.

Monitor Thermaload Starter—actual size 11¾ in. high, 10¾ in. wide, 6¾ in. deep.

1—A substantial sheet metal box encloses the starter which is self-contained and ready for operation when shipped from the factory.

2—Terminals for three-wire pilot circuit leading to push-button stations.

3—Thermal relay of new patented type. The same relay is used for all ratings.

4—Contact arm of relay.

5—One of the powerful expansible elements of the relay.

6—Flutter-proof contact of the relay.

7—Adjustable head of expansible thermal element which permits accurate adjustment of setting to meet peculiar service conditions.

8—Clamp for locking adjustment.

9—Interchangeable heater. Any desired rating may be obtained by using the proper heater. The heater consumption is only 2.14 watts, which gives an absolutely negligible drop in series with even the smallest motors.

10—The box may be locked or sealed so as to prevent disturbance by unauthorized persons.

11—Contactor terminals leading to motor. Logical arrangement of terminals makes wiring simple.

12—Standard Monitor a.c. contactor built with a laminated frame of electrical steel, which gives extra heavy contact pressure with only 15 watts coil consumption.

13—Standard Monitor contactor arm which may be removed for inspection without the use of a screw driver. This arm is flexibly mounted in positive position and gives constant contact pressure, with a wiping make and break.

14—Dropped-forged copper contacts.

15—Arc shields attached to panel board, but may be detached without tools. They prevent arcing between lines even with the box cover open as when testing.

16—Line terminals of contactor.

Monitor Controller Company

Boston Chicago Cleveland Detroit New York Philadelphia Pittsburgh St. Louis Buffalo Cincinnati

BALTIMORE, MD.

Metropolitan 2600 Volt Primary Cutouts

Stand Up Under Hard Usage and Give Real Satisfaction

Strength of structure is provided for in the heavy porcelain. Designed to be weather-proof when installed on the cross-arms and each conductor is held in position in the terminals by two screws to prevent loose connections. All live parts are amply recessed and protected to prevent injury from contact.

Positive protection to your branch circuits, transformers and arc lamp circuits is given—in case of trouble the circuit is instantaneously opened, especially where the disruptive effect is severe, due to high capacity.

A dependable factor of safety has been employed in the use of contact surfaces and installation.

List No. 10350
Primary Cutout
0 to 100 Amperes

Metropolitan All-Metal Seals

GUARANTEE PROTECTION

No Sealing Tools Required

Let us tell you about them.

Metropolitan Device Corporation
1250 Atlantic Avenue, Brooklyn, N. Y.

METROPOLITAN DEVICE CORPORATION,
1250 Atlantic Ave., Brooklyn, N. Y.

Gentlemen: Please send on 30 days' approval for trial, two list No. 10350 Primary Pole Cutouts 2600 volts, with ..... ampere fuses for same. If satisfactory I will send you order covering material sent.

Please send your latest data on All-Metal Seals. It is understood, that this incurs no obligation.

Name of Company .....
By ..... Title .....
Address .....
.....
Date .....
Check both items. ☐ All-Metal Seals. ☐ Primary Pole Cutouts.

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR., and D. H. BRAYMER, Editors

EARL E. WHITEHORNE, Commercial Editor
S. B. WILLIAMS, Assistant Managing Editor
A. M. PERRY, Engineering Editor
J. C. MARTIN, Western Editor
G. E. ARMSTRONG, Pacific Coast Editor
H. S. KNOWLTON, New England Editor

Associate Editors: T. P. KINDIG, B. M. DAVIS, H. H. STINSON, R. L. SHEPHERD, F. C. WELLS

Volume 79 New York, Saturday, January 14, 1922 *Number* 2

What Does It Cost to Wait?

ACCORDING to the statistics for 1920, the value of all the commodities produced in the United States in that year totaled seventy billion dollars. These goods were harvested or mined or manufactured. They were sold and sold and sold as they progressed from the producer to the consumer.

As these commodities were moved along, this money that they represented was turned over time and time again. Interest on it, calculated at 6 per cent, exceeded $11,500,000 every day. And this almost unthinkable amount was won or lost each day by some one, either because it was possible for him to turn the goods he held into cash that day or because he had to hold them over until tomorrow. Delayed shipments, delayed deliveries, delayed collections, delays from start to finish all along the line of distribution, were wasting capital and losing profits just as definitely as though the goods had been lying dead in frozen shelf or warehouse stocks or the money that they represented had been buried in a sack.

BUT there was another kind of delay that cost as much per day as this slow handling of the goods. It was *delay in selling*. And delay in selling is going to rob American industries this year of more in interest loss than it has ever sacrificed before unless American business men stop waiting for bad times slowly to go and set to work to make good times come back at once.

People are human and procrastination is a traditional human failing much condoned. If a man is slow and does not get things done on time, it is supposed to be too bad—for him. But when it bulks together and becomes a matter of $11,500,000 loss to the business men of the United States on every day of unnecessary delay in selling the nation's goods, it is something to be thought about. And the picture of the electrical industry all set to go but waiting "for things gradually to pick up" takes on an aspect of dollars and cents and prompts the question: What does it cost to wait?

IT would be well if every manufacturer and jobber would lock his desk for thirty days and take the road to spread this thought. For we must speed all laggards up by carrying to the men in every town real conviction that they can wire houses *now* and sell their goods *today*.

Business can be increased by working harder. Delay in selling can be reduced by selling faster. The money that it costs to wait can be turned into profits by not waiting. Automatically this greater profit can be made to create these "good times" we hunger for.

Oscar Dickinson Street

An executive operating a system of fifty jobbing houses who has built up one of the most efficient distribution organizations in the electrical industry.

ONE of the most pressing issues before the industries of America today is the broad problem of distribution. Through the recent years of rapid scientific advancement our methods of production have made great progress in efficiency and resource, but our systems of disseminating our foodstuffs, our raw materials and our manufactured goods to the consumer have not kept pace. The processes of distribution are costing our people too much, and electrical men along with men of other lines have come to realize that perhaps here must soon be wrought the next important step in the economic evolution.

Of all those now engaged in the business of distributing electrical supplies, probably no other individual has had so extensive an opportunity to study this problem as O. D. Street, general manager of distribution of the Western Electric Company and executive of the fifty jobbing houses operated by the Western Electric system in as many cities. These branch houses serve the entire United States, from coast to coast and from the Great Lakes to the Gulf. They maintain an intimate contact with the varying conditions in all sections of the country and provide an experience impossible in an ordinary jobbing business restricted to the usual territory that may be served from a single warehouse. As the operating head of this great distribution system Mr. Street has acquired a practical knowledge and vision of the electrical jobbing business that has made him an authority.

Mr. Street was born in Massachusetts in 1877. During the last four years of his schooling he worked after hours behind the counters of four different kinds of retail stores. Then he went to college and after a major course in economics was graduated from Williams in 1901. He then joined the Western Electric Company and spent the next year and a half in a training which carried him through all departments, including office, factory and stock. Then he was sent to San Francisco to take charge of telephone sales on the Pacific Coast, remaining there until recalled to act as assistant to President E. M. Barton. Here he gained a broad executive contact, and promotion followed first to the management of the Atlanta branch, next as general telephone sales manager and then as general manager of distribution with a far more complicated problem of distribution and operation.

During the war Mr. Street rendered invaluable service to the nation by reorganizing the warehousing division of the Quartermaster's Corps and establishing an orderly system of forwarding to Pershing's Army where chaos had existed before. Under his administration the Western Electric system has been expanded by the creation of twenty-two branch houses and there has been perfected a degree of standardized efficiency alike in the warehouses, the offices and the sales departments that merits close study by other electrical distributers.

Mr. Street is gifted with a searching mind and a clarity of vision that have given him a rare capacity for practical analysis, constructive organization and progressive development. He believes that the function of the jobber is (1) to provide a more economical means of distribution than is possible direct from manufacturer to trade; (2) to afford a broader market for the manufacturer's goods, and (3) to make possible through service a greater success for the dealer. He believes that the profits of the jobber in the future will be gained more by scientific warehousing and merchandising than by scientific salesmanship; and to that end he has bent his energies to the study of costs and methods both in principle and in the detail of practice. For it is his opinion that only through a knowledge of the cost of operations can a jobber know what class of merchandise it pays to sell and what class of customers it pays to serve, and only in this way can he maintain not alone the prosperity of his business but his very ability to function economically and maintain his place in the established plan of distributing electrical supplies.

Editorial Comment

Electrical World, January 14, 1922

Volume 79 Number 2

Safety Code Is Entitled to Support

AFTER all the discussion of which it has been the center, there is still a tendency to misunderstand what the National Electrical Safety Code really is. Recent discussions indicate a tendency on the part of some to consider it as a statement of the attitude of central-station companies on the requirements that should govern line construction. Those who so deem it take the attitude in controversy that it is composed of one-sided minimum requirements that should be upset and something more drastic substituted. The safety code has its weaknesses, but it represents, above all, the only compilation of rules on which all branches of industry interested in central-station operation and construction have in any manner approached agreement. While the code will probably have to be modified somewhat and be made less general, it must be remembered that it is the product of a long period of controversy in which all sides have had a full opportunity to present their views. Although the Bureau of Standards necessarily took opposing views, these have been harmonized into a compromise which, while in some respects not all that can be desired, is the best that has so far been attained. Regardless of what individual viewpoints may be, the code is entitled to the united support of all industries concerned. Any other course is certain to produce anew the confusion, due to conflict of interest, that was so marked eight or ten years ago. The Bureau of Standards has expressed its intention of revising the code as further study shows need and offers a full opportunity to every one for the presentation of data and suggestions. Attempts to amend the code by discrediting it through the action of commissions or other bodies are short-sighted in policy and cannot fail to bring chaos later on.

The New Spirit Down in Washington

THERE is a distinct encouragement for the business man in the story elsewhere in this issue of the work that the Department of Commerce is doing for industry under the administration of Secretary Hoover. For the first time within recollection, it seems, we have the refreshing spectacle of a great government department coming to business men to ask how it can serve them best instead of striving to regulate and legislate for business on the basis of the imagination and ambitions of the official and the employee. It is a most practical expression of the new idea of less government of business and more business in government that Mr. Hoover and Director of the Budget Dawes are talking and fighting for so energetically.

The detail story which Mr. Feiker tells of the work that is being done for standardization by the new "Division of Simplified Commercial Practice" should be an inspiration to the exponents of better standardization in the electrical industry. It is a forceful picture of the good that may come of this kind of waste elimination and of the ease with which such benefit may be had when once the leaders of an industry sit down to see what they can do to make their contribution to a national movement of this sort. And the manner in which the trade association is contributing in several industries to the advancement of this work is worthy of some thought.

But the best of it all is the promise which it holds of a more intimate contact between our government and our men of business and a more helpful understanding between them. It is good to hear of this work that the government is doing. As an industry what can we do to help the government go still further?

Superpower Necessary to Economical Service

THE need for a larger and national viewpoint on power production grows more and more imperative. The federal government has sensed it and through its power survey has crystallized thought along that line. It is important, therefore, that the existing utilities give the matter serious consideration. Great Britain, which is plagued with a greater number of electric systems than a centipede has of legs, has been forced to find a solution to her power problem. For some years now she has had an electric power supply committee at work on the subject. To make sure that the utilities would be subservient to the needs and interests of the general community, large powers have been vested in the commission. It can, for instance, enforce the policy of pooling resources, the standardization of voltages and frequencies, the erection of huge power houses and their interconnection with other efficient generating systems, the establishment of reasonable rates for service, and, besides possessing the equivalent of the power of eminent domain, can sanction loans and do away with small and inefficient plants. There is no denying the wisdom of such a scheme. If the war had lasted much longer, we should have been forced to superpower systems in most of the large industrial districts in this country, just as the railroads were forced to consolidate and pool their terminals, equipment and ticket offices. The public convenience is served by these measures, and if the plans are properly carried out, substantial public benefit results as well.

Obviously a solution must be soon found. The question is, shall the utilities under private management in this country take up this problem first and solve it, or shall government force the issue as it did in the case of the Province of Ontario or as it is doing at present in Great Britain? We have in this country interconnected systems which are the marvel of the world, but greater unification is still possible and greater economy as well. The country still abounds with thousands of

isolated systems, inefficient, unreliable and costly, which should be welded into less than one hundred groups and made to serve twice the territory now covered from one-tenth as many generating stations. Colonel Kellar's report on the power situation during the war indicates the economic possibilities in the great industrial sections in the country, as does also Mr. Murray's Boston-to-Washington superpower survey. Were the possible economies only partly realized, the carrying out of the plans suggested would be of immense benefit to the utilities and the general public as well.

Surge Possibilities Important in Adopting Higher-Voltage Cable

ITALIAN engineers, who are excelled by none in resourcefulness, have taken the lead in underground practice. For the last seven or eight years they have been working successfully cables of 40,000 volts and 50,000 volts and are now, according to Philip Torchio, who has recently made a survey of European practices, undertaking the installation of single-conductor cable for 80,000 volts. The only troubles encountered have been from surges originating in the overhead part of the system. Three-conductor cables up to 33,000 volts have also been in use abroad, and one has been made in this country by the Commonwealth Edison Company. The New York Edison Company is getting ready to try some 45,000-volt, single-conductor cable. There has been very material improvement in dielectrics, resulting in considerably decreased loss and thereby rendering it possible to work at somewhat higher temperatures, the limitation in this respect being the danger of expansion of the lead coverings, leaving air spaces in which ionization may take place with serious results.

In this increase of pressure in underground cables the main trouble to be feared is not failure from normal operation in the cable itself but surging and similar manifestations due to the connection of the cables to overhead circuits. Just how far it would pay to push up the voltage of cables is a matter which is very intimately associated with the general distribution now being undertaken. So little underground work in this country is quite straight-away and so much is mixed up with all sorts of complexities of distribution inherited from past years that it is no small task to get down to the basic economics of underground service. One thing is certain—that cables are quite available for higher pressures than we are inclined for the present to take on.

Savings Bank Investments and Electric Public Utilities

THE laws of every state throw unusual safeguards around the savings banks because they are the people's institutions. Not for investment, not for gain or reward, does the workman place in them his hard-earned savings, but for safekeeping. Safety is the primary requisite, and in every state the nature of the investments savings banks are permitted to make is specifically set forth in detail in the law itself, so that so far as it is humanly possible to do so the depositor is guaranteed against loss. The mutual savings banks of the country command deposits of about six billion dollars held in the interest of more than ten million depositors, who show greater confidence in them than they do in commercial banks or even post offices with savings departments. By law a certain percentage of the deposits may be invested in interest-bearing bonds of the United States, states, cities, municipalities, towns, etc., in real estate mortgages and in railroad securities. In a few states the securities of public utilities are also included to a limited extent. Feeling that, within properly safeguarded limits, the securities of electric public utilities possess the elements both of security and liquidity to warrant their inclusion among the investments open to mutual savings banks, the National Electric Light Association has appointed a committee to work with a similar committee from mutual savings banks in an endeavor to have the state laws amended to that extent.

There is a growing appreciation on the part of savings-bank investment committees that certain classes of seasoned public utility securities can be safely bought, and it is significant that the savings banks and public utility organizations have joined hands for a closer study of the matter. About twelve years ago California adopted what bankers admit to be one of the most scientific, thorough and practical banking codes in the country. By the California law savings banks may invest in the bonds of any railroad, street railway, water, gas, light, telephone, telegraph or other public utility incorporated under the laws of the state and operating its property in part within the state, provided that the net earnings of the utility reach a certain amount and that certain guarantees as to both principal and interest are given. It is to be hoped that the joint committee may succeed in getting other states to adopt like progressive legislation. Regulated as they are by public authority, the time ought not to be far distant when the securities of electric public utilities will be as stable and as safe as the securities of the municipalities and the states themselves.

Reactance Important in Furnace Operation

ORIGINALLY one of the bugbears of all forms of alternating-current generation and utilization, inductive reactance has through study and understanding advanced from the position of a thing to be feared and avoided to a point where it is treated with respect and even courted as an agent which under control may contribute to successful operation. Its importance in all forms of radio and telephone equipment for tuning, coupling and similar service is well known. In the power field its chief value lies in its current-limiting properties, to take advantage of which the reactance of lines, generators and transformers is often increased. An account of the use of reactance for improving the operation of electric furnaces is given in the article by P. B. Short in this issue. It presents an interesting example of the control which engineering knowledge and experience now exercises over the now obedient servant, inductive reactance.

A moderate reactance is necessary for satisfactory furnace operation, say 40 per cent corresponding to a power factor of 92 per cent. Part of this may be in the transformers and leads, but usually an additional reactor is necessary. This must often be of variable value to take care of starting as well as operating conditions. Although the furnace is often subject to complete short circuit and sharp current surges, owing to the high value of reactance necessary for satisfactory operation, the necessary protection may be had in an iron-core reactor. Since two and a half times full-load current is the limit

reached, a core of moderate size will not saturate. Further adjustable values for different conditions of operation and ready alteration to higher values to follow the present tendency to higher voltages are easily possible.

A Translation of the Building Situation

STATISTICIANS tell us that 1,200,000 homes, 22,000 apartment buildings, 5,000 public schools and 20,000 office and public buildings, factories, etc., must be built in this country before we shall stand equipped as we would have been if war had not interrupted our usual continuous building construction. For six years we have been marking time. Now business is on the positive increase and confidence and initiative are responding to the impulse. The erection of residence, business and public buildings will follow with cumulative acceleration.

These numerals alone are big and interesting enough, but translate them into the equivalents in electrical material and the mind refuses to grapple with the calculation. If there are to be 1,247,000 new buildings, how much wire will it take? How many switches, sockets and receptacles? How many lamps, shades and fixtures? How many motors? How many fans? How many heating devices both domestic and industrial? How many household labor-saving appliances? How many new power units to supply the energy? How many kilowatt-hours? How many orders? How much profit? Figure it a little on your favorite pad.

A graphic analysis of what this means was presented in last week's issue, and elsewhere in this issue further figures are given showing the growth in electrically lighted houses, with a five-year forecast.

Our Interest in the Thrift Campaign

A WORTHY opportunity presents itself to every central-station company in the great and growing work of preaching and teaching thrift to all the people. There is no better way for any man to save than to buy securities, and there are no better securities to buy today than those sold by utility companies. Here is a point of contact and a purpose that should engage the interest of every light and power company executive, and there is no better time than now to make this interest felt.

Next week will be devoted throughout the country by many earnest workers to the annual national "drive" for thrift. Under the leadership of the Y. M. C. A., organizations and individuals everywhere will unite in a co-operative campaign to carry this message to the people. Beginning as it does on the birthday of Benjamin Franklin, the great American exponent of thrift, the drive should have particular appeal to electrical men. It is seemingly well grounded, with a definite program of daily activities by which the effort is to be directed. The basis of the movement is a ten-point economic creed combining these strikingly well-chosen admonitions: "Work and earn," "Make a budget," "Record expenditures," "Have a bank account," "Carry life insurance," "Own your home," "Make a will," "Invest in safe securities," "Pay bills promptly," "Share with others."

Separate days are to be set apart as "Budget Day," "Make-a-Will Day" and so on. We suggest to the electric light and power companies a "Buy Securities Day" in each locality, on which day the thrift value of utility stock might be interpreted to the community.

Industrial Phases of Electric Service Need Painstaking Study

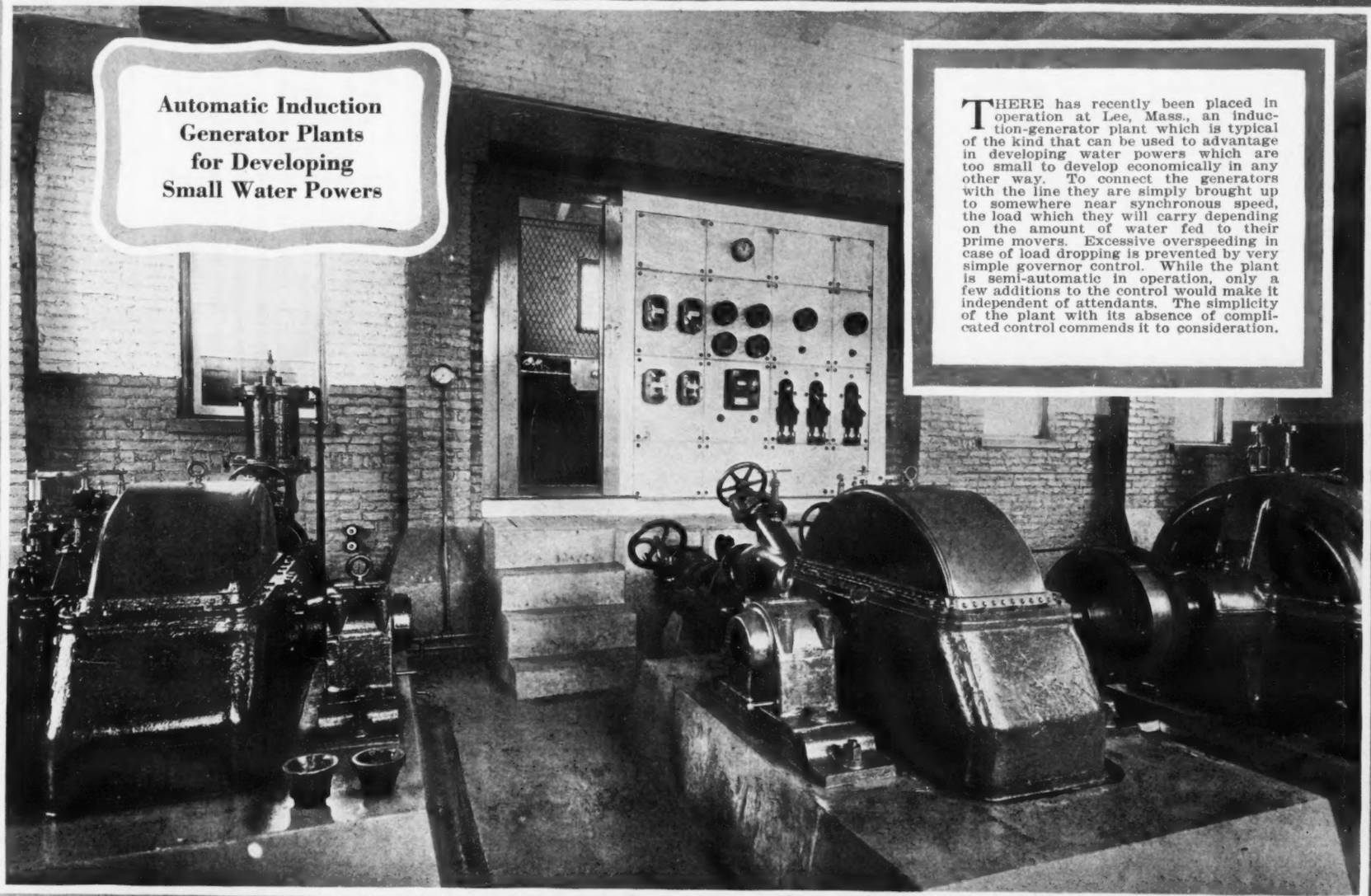
THE study of industrial distribution with respect to working voltages, the control of industrial service presenting needlessly bad load conditions and the remedial effect of condensers are well worthy of the painstaking study of engineers during the coming year, which is more than likely to show still further increase in industrial work and a much greater need for its thorough control.

To any one whose first experience in central-station practice was gained a score of years or even a decade ago the present situation with respect to distribution of load is like breaking in on the economics of another planet. In the old days when the lighting load was predominant in its financial importance and its value to the community the technical situation of the central station was comparatively simple. Today, with the vast increase in industrial service, an entirely new group of conditions control the situation. Fundamentally the use of big motors for industrial purposes over the wide area that depends for service on every central station raises questions of voltage and kind of distribution which cannot be dodged. The older and simpler methods break down when applied on the scale that is now imperative. It is not easy to generalize regarding the nature of the problems involved, but one cannot help feeling that increase of distribution voltages, very likely with the more general employment of the four-wire, three-phase distribution, is coming to lighten the burden of distance and the difficulties of regulation. When one stops to think that the United States is virtually the only large country in which the 110-volt lamp is dominant, he comes to a realization of the self-imposed limitations which have to be faced, and these are as important in the power field as in that of lighting.

Power-factor control is another problem of predominant importance and one which should be thoroughly investigated. In the very early days of the three-phase system power factor was a grave matter indeed. Motors were actually put into service that would barely start themselves running light and that even at full load showed power factors which would give a modern engineer the cold shivers. As time went on the situation bettered itself, particularly as motors were not a large factor in the load. At the present time the load of motors is so great that power factor has assumed renewed importance. The problem is due now not so much to poorly designed motors as to motors operating at load factors which, taking everything into consideration, are atrociously bad.

Whether it is better to go out on a punitive expedition and compel better practice or to improve the technical situation is a matter of doubt. We have inclined to the belief that a good kilovolt-ampere-hour meter for three-phase circuits, the bills to be prepared on its evidence, would do wonders in checking careless practice. Another line of advance is through the compensation of power-factor static condensers, tried thirty years back with a good measure of success on a small scale and now to the front again with some hope of use upon a large scale. What we need now more than anything else is a careful study of the economics and effects of placing condensers at various points. What we hear of their modern development is altogether encouraging, and yet it may be somewhat futile to use them to avert conditions of loading which ought not to be allowed to exist.

Automatic Induction Generator Plants for Developing Small Water Powers



THERE has recently been placed in operation at Lee, Mass., an induction-generator plant which is typical of the kind that can be used to advantage in developing water powers which are too small to develop economically in any other way. To connect the generators with the line they are simply brought up to somewhere near synchronous speed, the load which they will carry depending on the amount of water fed to their prime movers. Excessive overspeeding in case of load dropping is prevented by very simple governor control. While the plant is semi-automatic in operation, only a few additions to the control would make it independent of attendants. The simplicity of the plant with its absence of complicated control commends it to consideration.

What the Department of Commerce Is Doing for Industry

An Outline of the Practical Results that the Three Bureaus Which Serve the Business Man Are Achieving — The Opportunity for Co-operation with the Trade Association

By F. M. FEIKER
Assistant to the Secretary of Commerce and Vice-President of the McGraw-Hill Company

MOST electrical men and men of other industries have but a vague idea of the functions of the United States Department of Commerce and the work which it is actually achieving for them. Yet there are three bureaus in the department that concern the electrical business intimately and are rendering a valuable service. I believe that some of the details of this work will be of interest.

In the first place the Department of Commerce consists of seven principal bureaus and divisions associated with commerce. They are the Bureau of Fisheries, the Bureau of Navigation, the Bureau of Steamboat Inspection, the Bureau of Lighthouses and the three others I have referred to, which are the Bureau of Census, the Bureau of Foreign and Domestic Commerce and the Bureau of Standards. It is the three last-named bureaus in particular with which I have been working since I have been in Washington, and some very material changes have been effected both in the scope and in the point of view during the present administration.

When Mr. Hoover went to Washington last March about the first thing he did was to call together leading business men from all the industries, among them a good many representatives from the electrical industries, and say to them: "Here is the Department of Commerce, with the miscellaneous bureaus which go to make it up—what can it do for you?" For the first time, I think, a Secretary of Commerce went to collective industry to find out what the department could do for it, instead of imagining some things that it might do and turning those back on industry. It is not trying to regulate business or to exercise government control, but it is aiming to set itself up as a place where American business can express itself through the government and where the department in turn can perform useful services for business.

I have been working for six months upon the questions of personnel and organization to carry out this policy. I can perhaps best describe how we are going about it by telling what we have been doing in the Bureau of Foreign and Domestic Commerce. In the first place, it hasn't anything to do with domestic commerce. Congress, in its wisdom, passed an empowering act establishing a Bureau of Foreign and Domestic Commerce and in one paragraph said that it would have nothing to do with domestic business. Therefore the Bureau of Foreign and Domestic Commerce at the present time has only to do with foreign commerce. It still bears "Domestic Commerce" in its title, and I am hoping to see industry demand the development of the domestic side.

This bureau had been built up solely on the geographical basis. There was a man in charge of the Far Eastern Division, and another of the South American Division, and another of the European Division, and so on, and if an electrical manufacturer or jobber wanted to know what was going on in all the markets around the world, there was no contact man with special electrical knowledge in the department.

I have been working, under Mr. Hoover's general plan, helping Dr. Kline, the chief of the bureau, to reorganize the department on a commodity basis, so called, as well as a geographical basis. There is in the department now an electrical man, R. A. Lundquist, who probably knows more about electrical foreign markets generally than any other single man in the United States. He has at his beck and call the six hundred contact men of the department who are abroad, the commercial attachés and the consuls and the trade commissioners, and also as his advisers the men in the industry. For a part of the program is to work out committees with the organizations in the industry through which the Department of Commerce may go, and these commodity men may go, to find out what the industry wants done in this foreign trade.

GETTING THE MEN

Let me be a little more specific. The Automobile Division has got along a little further than the others. We went to the Automobile Chamber of Commerce and we said, "We want two men for this commodity work."

"How much can you pay them?" they asked. "Maximum, five thousand dollars," we told them, "and we want a ten-thousand-dollar man for that."

And we got him, because we got the association back of it. The association interviewed ninety-eight men and picked out two, and we have two men down there in Washington with the backing of the association, worth much more than the money they are getting, and we have already begun to get some very definite things done in the automobile industry as far as foreign trade is concerned. These men are first contact men with industry, getting the ideas through the collective action of the association into the department, and then getting the stuff that is in the department back to industry in some usable and simplified form. A committee of electrical manufacturers has recently been formed to make its contact with the electrical man in that department, and there are other committees to be formed to make contact with some of the other divisions.

Many electrical men have had some contact with the Bureau of Standards. This bureau is the largest research laboratory in the world. It has the largest equipment for research of any government bureau in the world, and it has about four functions.

In the first place, it is a sort of a laboratory for all

the other government buying departments. If the Congressional Library wants to buy a copper gutter, it goes to the Bureau of Standards to find out what is the most approved type at the present time, and through this activity there has been built up a series of specifications for government purchases.

A second function of the department might be compared with the village scale; but it is not so much the simple establishment of physical standards of weights and measures, in the older sense, that is sought as it is to relate these standards to industry, with the co-operation of the industry. For most of the trouble in standardization comes by not having the standards come out of the industry itself first, but by trying to force something in the way of standards back to industry.

DIVISION OF SIMPLIFIED COMMERCIAL PRACTICE

What Dr. Stratton is trying to do in the Bureau of Standards is to make this plain to business men, and we have set up completely a new division of the Bureau of Standards, to be called the Division of Simplified Commercial Practice. W. A. Durgin, who has been assistant to Vice-President Ferguson of the Commonwealth Edison Company of Chicago, has been loaned by Mr. Insull to head that job. I am glad that an electrical man is there, although the job to be done is very much larger than the electrical side alone.

Let me picture that job in a moment or two. We have in this country a great many organizations working on this matter of the elimination of waste. The Bureau of Standards has started certain programs leading to simplification of production programs and standardization of measurement, and that sort of thing. Besides, for example, the automobile tire manufacturers are now working out a series of standard specifications intended to eliminate the excess number of sizes of tires. If all those miscellaneous sizes are cut out, there will result a great saving of material and products now tied up in stocks of dealers and manufacturers. We have now started a Division of Building and Housing which will do this same kind of standardization work for the building industry.

All over this country houses are being built. The cost of construction will never probably go back to where it was before the war as regards the cost of materials. Probably the cost of labor will never go back completely. That means that we have got to increase individual production; we shall have to work harder. We have got to use material and labor and capital more effectively and use less material and labor and capital than we have done before. The way to do that is to introduce into industry as a whole certain elements of standardization and uniformity so we will cut out the wastes that go on in industry in certain detailed operations.

To accomplish this in the Division of Building and Housing, first, we have got together all the building codes in the country, the municipal building codes, and any one who thinks that the electrical industry is lax in the matter of diverse codes should look at these. Every municipal building code in the country varies from every other building code. An 8-in. wall in one city is recommended as a fire wall for a house in a certain district, and a 12-in. wall in another city is a fire wall in a like district. An agreement has been reached through the commissioners and architects that an 8-in. wall is all that is necessary for a fire wall in a certain city zone. That means at once about a 20 per cent reduction of cost of certain kinds of building construction that require fire walls.

We have discovered in the plumbers' codes that in some places you have to trap a closet with two vents and in some places with one vent, and in some towns you have to run a vent pipe from every trap in the house and in some towns you can run a vent pipe from only three or four. We can cut out about 20 per cent of the cost of plumbing if we can discover what is the right way to trap and vent a house and otherwise simplify and codify plumbing codes. There is a committee now at work on that—a committee of plumbers, not a committee of the government—to tell us what to tell them, which is a very practical way to get at this thing.

Now, along that line there are probably certain opportunities for the standardization of equipment for small houses. We have brought together a committee of architects and they are working out plans for small houses to be used by the contractors and the carpenters in the small towns where an architect is not ordinarily employed by the owner. These small houses, of good design and character, are to be built up of combinations of standards already available in the trade but generally unknown.

The sash and door manufacturers, for example, have said that today a man will order a door 6 ft. 11 in. high and 32 in. wide, and tomorrow another man will order a door 6 ft. 10 in. high and 31 in. wide, and the next day another fellow wants still a different dimension, when the largest volume of their orders are for doors 7 ft. high and 32 in. wide. Now, if we can get everybody to say that is a standard size, then we can agree on that size and it will cost considerably less on account of its being produced in quantity. So we are tackling that problem, through a committee of the sash and door men, who are going to make a survey of all the sash and door sizes there are, and as a result we are probably going to cancel about 50 per cent of the sizes by mutual consent and set up standards to be used by the building trades in certain classes of house construction.

The third group that is undertaking this work is the Federated American Engineering Societies. You have seen something of its report on the "Elimination of Waste in Industry," in which a committee of engineers, under the inspection of Mr. Hoover as chairman, has produced a remarkable basis for analyzing industrial wastes.

TRADE ASSOCIATION HELPING

The fourth group is one started by the trade associations themselves, and here is an example of what they are doing. The paving-brick manufacturers have been trying for three years to introduce standards for the paving-brick industry. There were something like thirty styles and varieties of paving brick manufactured, and they wanted somebody to help them out of the woods, because every time they started to tell anybody there ought to be only three or four, the men that bought them said, "Oh, you are trying to put something over on us."

We said to them: "The first thing to do is to get together as an industry and find out really what you are doing yourselves. Go out and make a survey; use the name of the Department of Commerce to get facts from men who probably would not give them to you if you asked them for yourselves alone."

They made a wonderful report. They analyzed the sales of paving brick of 90 per cent of the manufacturers

in the paving-brick industry for this country for the last eight years. They found not thirty but sixty-six sizes and varieties of paving brick now being made. They put down the sales of all the sixty-six varieties for the last eight years. Here was something to talk about. So, in the name of the Department of Commerce, we issued an invitation to the municipal engineers and the architects and the technical societies and the manufacturers, who are the buyers of paving brick, and there were some thirty-three associations represented. We called a meeting in Washington and we laid the report before them.

"Now," we said, "gentlemen, what does common sense say we ought to do? We are not going to force you to do anything." All it required was common sense, and they looked down the total column and in one resolution eliminated from sixty-six down to twenty, by mutual consent. Then we appointed a committee, and it took the twenty sizes remaining and spent the noon-hour luncheon with them and cut them down to eleven.

We left at the end of one day with sixty-six varieties cut to eleven, without forcing it on anybody. The municipal engineers went back to their association to recommend these sizes as standard in their association, and the Navy Department has already sent in and said that hereafter all the bricks ordered by the department will be ordered on those standard sizes. In one day we accomplished something that only the Department of Commerce, exercising this particular function, could possibly do. We have already requests from several other industries to do just that sort of thing. It is this kind of work that is going to be the basis of what Mr. Durgin is going to head.

Adding Prophecy to Census History

Now I want to jump to the Bureau of Census. The Bureau of Census has habitually got out historical figures two years after the time we take them. They are essential and important as records, but not immediately useful. Mr. Hoover says that we don't want history alone from the Bureau of Census, for we also want prophecy. So one of my jobs has been to help put prophecy into the Bureau of Census. But instead of trying to remake the Bureau of Census, with its tremendous machinery, handling over a billion cards for example, to take one population census, we added a little staff of prophets. These men pick out of the Census and other government bureaus those facts that show trends in business, and our *Monthly Survey of Business* shows these trends in industry and production, in stocks, in various lines throughout the country. In that work we have asked and received the co-operation of thirty-five or forty trade associations very freely in getting statistics.

It is utterly impossible to build up any government machinery quickly if you are getting monthly figures. Instead of that, we are looking to the secretaries of associations to function, if you will, as government representatives in handling their end through providing totals of production and stocks from their statistical work which can go into the monthly surveys. Our sole purpose is to find, first, whether that association represents enough of the industry to be indicative of the trend, and whether it represents enough of the volume of that industry.

When we talk about statistics we talk about things that are usually uninteresting. So most of us make up our minds on opinion instead of facts, and most of us talk about the button on the coat instead of the coat itself. But before we make decisions about the distribution problem in this country, for instance, before we make up our minds too much on who ought to sell electrical goods, we should find out who they are. For fifty years in this country we have made a study of production, and in those fifty years we have eliminated certain wastes and have developed a certain kind of thinking about production, and we call it "industrial engineering." We have a type of man known as the "industrial engineer," but only in the last ten years have we begun to talk about distribution at all. We are now beginning to approach that subject in the same way we approached production. There is a type of man at work in industry that can have the same professional relation to the problems of distribution that the industrial engineer has to the problems of production, and that is the advertising man. But that is a story all by itself and one too long to enter into here.

Must First Get Facts

What I want to say is that the distribution problem depends, first, on getting facts to talk about, and that we must not base our ideas and our policies on opinion only. The Department of Commerce hopes to help to get those facts on the matter of distribution.

There are no real statistics of retailing or of jobbing in the electrical industry. There are no real statistics in this country. I know that because I have been trying to find them for three months. There are a lot of pieces of statistics, but there are no real, comprehensive statistics, and that applies not only to one but to all industries. Every time a man gets hold of a piece of it he builds up a great, big case on that piece. But before we start building up cases on distribution, let's be sure we have all the pieces. Before we put the contractor-dealer out of business, let's be sure we are talking about the right pieces and about all the pieces. Before we talk about who is the right man to merchandise, let's see who is merchandising today. And before we begin to reorganize our businesses let's see what is actually being done today.

Distribution Survey Suggested

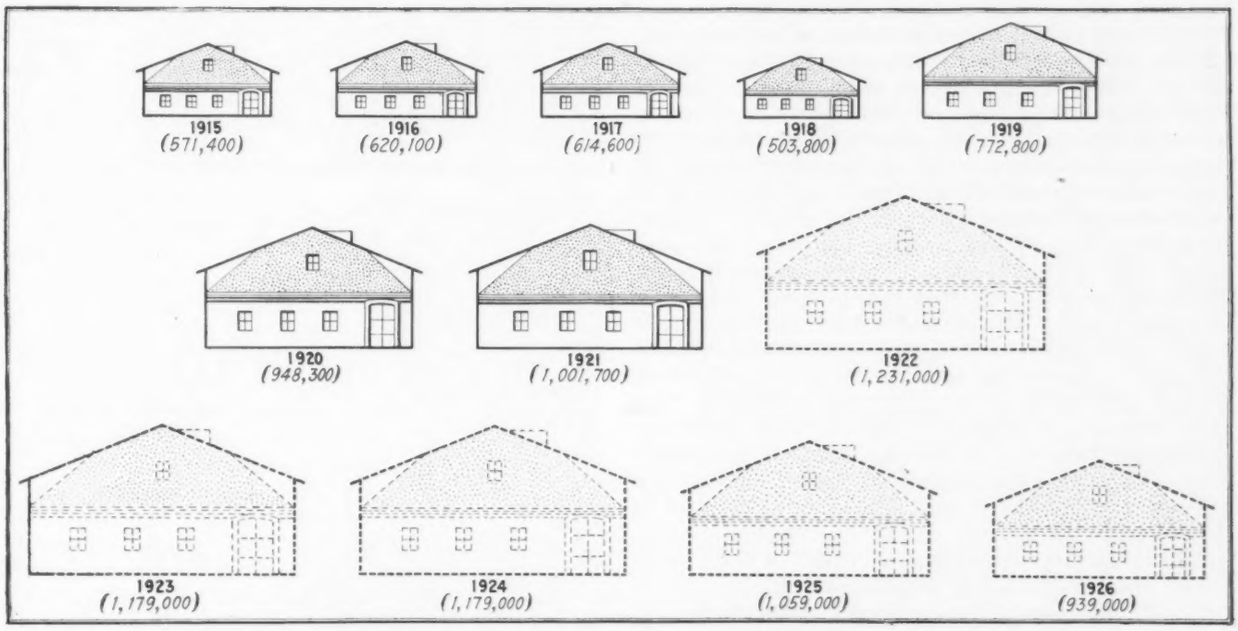
Now, so far as the Department of Commerce is concerned, the problem is tremendously broader than the work that the intimate association or any individual can do. But if some electrical association would undertake to make a real survey of the distribution elements it would be a practical start that would get somewhere. We should have something to put up on the wall and to talk about that wasn't the buttons on the coat but the coat itself. Until we do that we are never going to answer the question.

I have attended electrical meetings for six years and heard discussions about distribution and who is the right man to sell. A lot of us have a tremendous amount of individual knowledge, but all of us haven't the common knowledge or the common belief, which is much the same thing. We have to have in that knowledge, first, the fact and then the belief in the fact. Now, the one way to get belief in facts is to add the government stamp of approval to those facts. That is the contribution the Department of Commerce is trying to make in this work, to add a stamp of approval on facts which in themselves will carry the moral support so that everybody can organize around them and will then go and get something done on the facts.

Residential Lighting Customers Served by Electric Light and Power Companies

State and Sections	Jan. 1, 1916			Jan. 1, 1917			Jan. 1, 1918			Jan. 1, 1919			Jan. 1, 1920			Jan. 1, 1921			Jan. 1, 1922		
	Total Number (Thousands)	New Customers During 1915 (Thousands)	Per Cent Gain During 1915	Total Number (Thousands)	New Customers During 1916 (Thousands)	Per Cent Gain During 1916	Total Number (Thousands)	New Customers During 1917 (Thousands)	Per Cent Gain During 1917	Total Number (Thousands)	New Customers During 1918 (Thousands)	Per Cent Gain During 1918	Total Number (Thousands)	New Customers During 1919 (Thousands)	Per Cent Gain During 1919	Total Number (Thousands)	New Customers During 1920 (Thousands)	Per Cent Gain During 1920	Total Number (Thousands)	New Customers During 1921 (Thousands)	Per Cent Gain During 1921
United States	4,006.3	571.4	16.7	4,626.4	620.1	15.5	5,241.0	614.6	13.3	5,744.8	503.8	9.6	6,517.6	772.8	13.5	7,465.9	948.3	14.5	8,467.6	1,001.7	13.4
SECTIONS																					
New England	384.2	66.3	20.9	462.4	78.2	20.4	536.3	73.9	16.0	572.7	36.4	6.8	649.4	76.7	13.4	748.8	99.4	15.3	828.8	80.0	10.7
Middle Atlantic	596.5	122.5	25.8	674.8	78.3	13.1	796.8	122.0	18.1	902.9	106.1	13.3	1,085.0	182.1	20.2	1,259.0	174.0	16.0	1,522.0	263.0	20.6
South Atlantic	320.9	28.4	9.7	360.0	39.1	12.2	386.6	26.6	7.4	424.5	37.9	9.8	476.3	51.8	12.2	547.3	71.0	14.9	620.6	73.3	13.4
East North Central	968.4	123.7	14.6	1,160.0	191.6	19.8	1,331.5	171.5	14.8	1,471.2	139.7	10.5	1,686.8	215.6	14.7	1,955.0	268.2	15.9	2,237.8	282.8	14.5
West North Central	526.0	98.8	23.1	604.5	78.5	14.9	685.0	80.5	13.3	740.9	55.9	8.2	835.6	94.7	12.8	936.5	100.9	12.0	1,014.0	77.5	8.3
East South Central	160.2	12.2	8.2	181.0	20.8	13.0	198.0	17.0	9.4	212.3	14.3	7.2	237.8	25.5	12.0	285.7	47.9	20.1	330.5	44.8	15.7
West South Central	196.1	37.4	23.6	242.4	46.3	23.6	296.6	54.2	22.4	335.5	38.9	13.1	374.8	39.3	11.7	452.7	77.9	20.8	499.7	47.0	10.4
Mountain	226.4	20.1	9.7	264.2	37.8	16.7	289.8	25.6	9.7	304.1	14.3	4.9	316.0	11.9	3.9	327.0	11.0	3.5	346.7	19.7	6.0
Pacific	627.7	62.1	11.0	676.8	49.1	7.8	720.5	43.7	6.5	780.7	60.2	8.4	856.0	75.3	9.7	953.9	97.9	11.4	1,067.5	113.6	11.8
NEW ENGLAND:																					
Maine	47.7	8.9	23.5	53.3	5.6	11.7	66.3	13.0	24.4	74.5	8.2	12.4	78.5	4.0	5.4	90.5	12.0	15.3	100.0	9.5	10.5
New Hampshire	18.5	1.9	11.4	22.2	3.7	20.0	23.9	1.7	7.7	25.4	1.5	6.3	30.0	4.6	18.1	34.6	4.6	15.3	38.3	3.7	10.7
Vermont	29.7	2.3	8.4	31.1	1.4	4.7	32.1	1.0	5.5	32.8	0.7	2.2	36.5	3.7	11.3	42.1	5.6	15.4	46.0	3.9	9.3
Massachusetts	197.0	36.2	22.5	241.3	44.3	22.5	279.5	38.2	15.8	292.7	13.2	4.7	338.9	46.2	15.8	393.8	54.9	16.1	436.5	42.7	10.8
Rhode Island	24.1	4.5	23.0	30.1	6.0	24.9	34.5	4.4	14.6	36.1	1.6	4.6	42.5	6.4	17.7	49.0	6.5	15.3	57.8	8.8	18.3
Connecticut	67.2	12.4	22.6	84.8	17.6	26.2	100.0	15.2	17.9	111.3	11.3	11.3	123.0	11.7	10.5	138.8	15.8	12.8	150.2	11.4	8.3
MIDDLE ATLANTIC:																					
New York	222.3	40.5	22.2	272.6	50.3	22.6	336.0	63.4	23.2	392.0	56.0	16.7	480.0	88.0	22.5	552.0	72.0	15.0	686.0	134.0	24.3
New Jersey	136.7	16.7	13.9	156.4	19.7	14.4	177.0	20.6	13.2	190.2	13.2	7.5	220.0	29.8	15.7	254.0	34.0	15.5	293.0	39.0	15.4
Pennsylvania	237.5	65.3	37.9	245.8	8.3	3.5	283.8	38.0	15.5	320.7	36.9	13.0	385.0	64.3	20.1	453.0	68.0	17.7	543.0	90.0	19.8
SOUTH ATLANTIC:																					
Delaware	5.3	1.0	23.2	6.1	0.8	15.1	7.8	1.7	27.9	7.9	0.1	1.3	9.3	1.4	17.7	10.7	1.4	15.1	12.1	1.4	13.1
Maryland	33.5	3.6	12.1	38.1	4.6	13.7	41.8	3.7	9.7	45.1	3.3	7.9	53.2	8.1	18.0	67.2	14.0	26.3	77.6	10.4	15.5
District of Columbia	20.6	2.2	12.0	23.4	2.8	13.6	24.7	1.3	5.6	28.4	3.7	15.0	30.8	2.4	8.5	31.2	0.4	1.3	36.5	5.3	17.0
Virginia	62.0	6.2	11.1	71.3	9.3	15.0	77.1	5.8	8.1	81.4	4.3	5.6	92.0	10.6	13.0	98.3	6.3	6.8	112.2	13.9	14.1
West Virginia	15.7	3.3	26.6	19.5	3.7	23.6	23.8	4.3	22.0	32.2	8.4	35.3	38.0	5.8	18.0	44.1	6.1	16.0	51.3	7.2	16.3
North Carolina	35.4	4.3	13.8	38.0	2.6	7.3	39.5	1.5	4.0	44.4	4.9	12.4	50.0	5.6	12.6	57.4	7.4	14.8	65.1	7.7	13.4
South Carolina	35.0	2.1	6.4	37.6	2.6	7.4	39.0	1.4	3.7	44.5	5.5	14.1	51.0	6.5	14.6	58.7	7.7	15.1	66.5	7.8	13.3
Georgia	63.3	1.5	2.4	71.7	8.4	13.3	72.6	0.9	1.3	76.3	3.7	5.1	84.0	7.7	10.1	88.2	4.2	5.0	91.3	3.1	3.5
Florida	50.0	4.0	8.7	54.4	4.4	8.8	60.4	6.0	11.0	64.4	4.0	6.6	68.0	3.6	5.6	91.5	23.5	34.6	108.0	16.5	18.0
EAST NORTH CENTRAL:																					
Ohio	188.2	26.8	16.6	233.3	45.1	24.0	281.2	47.9	20.6	322.8	41.6	14.8	385.0	62.2	19.3	471.0	86.0	22.3	534.0	63.0	13.4
Indiana	124.7	5.2	4.4	141.0	16.3	13.1	156.4	15.4	10.9	169.7	13.3	8.5	191.8	22.1	13.0	221.8	30.0	15.6	248.0	26.2	11.8
Illinois	387.0	45.7	13.4	462.4	75.4	19.5	526.5	64.1	13.9	572.5	46.0	8.7	640.0	67.5	11.8	730.0	90.0	14.1	858.0	128.0	17.5
Michigan	172.7	33.7	24.2	214.8	42.1	24.4	251.0	36.2	16.9	275.8	24.8	9.9	320.0	44.2	16.0	371.2	51.2	16.0	425.0	53.8	14.5
Wisconsin	95.8	12.3	14.7	108.5	12.7	13.3	116.4	7.9	7.3	130.4	14.0	12.0	150.0	19.6	15.0	161.0	11.0	7.3	172.8	11.8	7.3
WEST NORTH CENTRAL:																					
Minnesota	105.8	19.6	22.8	126.3	20.5	19.4	149.0	22.7	18.0	163.5	14.5	9.7	192.0	28.5	17.4	233.5	41.5	21.6	261.5	28.0	12.0
Iowa	70.0	10.6	17.9	81.3	11.3	16.2	90.2	8.9	11.0	96.0	5.8	6.4	110.0	14.0	14.6	123.3	13.3	12.1	131.8	8.5	6.9
Missouri	161.0	29.0	22.0	172.4	11.4	7.1	180.2	7.8	4.5	191.3	11.1	6.2	212.0	20.7	10.8	237.5	25.5	12.0	250.7	13.2	5.6
North Dakota	29.9	6.2	26.2	34.6	4.7	15.7	40.3	5.7	16.5	40.7	0.4	1.0	42.3	1.6	4.0	47.5	5.2	12.3	51.5	4.0	8.4
South Dakota	28.6	4.7	19.7	30.8	2.2	7.7	32.1	1.3	4.2	33.1	1.0	3.1	39.3	6.2	18.8	44.1	4.8	12.2	46.3	2.2	5.0
Nebraska	61.5	8.7	16.5	67.9	6.4	10.4	75.2	7.3	10.8	81.0	5.8	7.7	90.0	9.0	11.1	96.9	6.9	7.7	101.2	4.3	4.4
Kansas	69.3	20.0	40.6	91.3	22.0	31.8	118.0	26.7	29.2	135.3	17.3	14.7	150.0	14.7	10.9	153.7	3.7	2.4	171.0	17.3	11.3
EAST SOUTH CENTRAL:																					
Kentucky	60.6	5.4	9.8	68.4	7.8	12.9	76.7	8.3	12.1	82.2	5.5	7.2	91.0	8.8	10.7	118.0	27.0	29.7	144.2	26.2	22.2
Tennessee	34.9	2.8	8.7	40.7	5.8	16.6	44.1	3.4	8.4	47.7	3.6	8.2	57.0	9.3	19.5	65.0	8.0	14.0	71.6	6.6	11.5
Alabama	38.4	1.9	5.2	43.3	4.9	12.8	45.4	2.1	4.8	48.5	3.1	6.8	54.0	5.5	11.3	65.1	11.1	20.6	75.8	10.7	16.5
Mississippi	26.3	2.1	8.7	28.6	2.3	8.8	31.8	3.2	11.2	33.9	2.1	6.6	35.8	1.9	5.6	37.6	1.8	5.0	38.9	1.3	3.5
WEST SOUTH CENTRAL:																					
Arkansas	29.9	3.9	15.0	34.7	4.8	16.1	39.0	4.3	12.4	42.6	3.6	9.2	48.3	5.7	13.4	57.0	8.7	18.0	62.1	5.1	9.0
Louisiana	28.1	3.7	15.2	32.6	4.5	16.0	36.7	4.1	12.6	40.1	3.4	9.3	45.5	5.4	13.5	54.5	9.0	19.8	59.5	5.0	9.2
Oklahoma	41.7	2.2	5.6	45.4	3.7	8.9	49.6	4.2	9.2	54.2	4.6	9.3	61.0	6.8	12.5	68.5	7.5	12.3	71.6	3.1	4.5
Texas	96.5	27.7	40.2	129.8	33.3	34.5	171.2	41.4	31.9	198.6	27.4	16.0	220.0	21.4	10.8	272.7	52.7	24.0	306.5	33.8	12.4
MOUNTAIN:																					
Montana	36.3	1.5	4.3	41.7	5.4	14.9	42.8	1.1	2.6	50.9	8.1	18.9	52.0	1.1	2.2	47.3	— 4.7	— 9.0	46.6	— 0.7	— 1.5
Idaho	26.7	3.8	16.6	29.5	2.8	10.5	32.1	2.6	8.8	34.6	2.5	7.8	38.5	3.9	11.3	40.2	1.7	4.5	42.5	2.3	5.8
Wyoming	9.3	1.3	16.2	10.2	0.9	9.7	11.3	1.1	10.8	12.2	0.9	8.0	13.6	1.4	11.5	15.7	2.1	15.5	18.8	3.1	19.8
Colorado	75.8	5.4	7.7	83.0	7.2	9.5	94.0	11.0	13.3	100.0	6.0	6.4	103.0	3.0	3.0	107.7	4.7	4.6	114.2	6.5	6.0
New Mexico	10.7	0.3	2.9	11.3	0.6	5.6	12.5	1.2	10.6	12.5	0.0	0.0	13.3	0.8	6.4	14.0	0.7	5.1	14.9	0.9	6.3
Arizona	8.4	1.7	25.4	10.0	1.6	19.1	11.0	1.0	10.0	11.8	0.8	7.3	12.1	0.3	2.5	13.7	1.6	12.9	15.7	2.0	15.0
Utah	41.2	5.0	13.8	60.8	19.6	47.6	69.2	8.4	13.8	68.7	—0.5	—0.7	69.0	1.3	1.9	73.1	4.1	6.0	78.3	5.2	7.0
Nevada	18.1	1.2	7.1	17.6	—0.5	—2.8	16.9	—0.7	—3.9	13.4	—3.5	—20.7	14.5	1.1	8.2	15.3	0.8	5.5	15.7	0.4	2.8
PACIFIC:																					
Washington	140.4	13.1	10.3	148.0	7.6	5.4	165.7	17.7	12.0	187.4	21.7	13.1	204.0	16.6	8.8	216.1	12.1	6.0	223.0	6.9	3.2
Oregon	61.3	5.5	9.9	63.8	2.5	4.1	66.8	3.0	4.7	75.3	8.5	12.7	82.0	6.7	8.9	87.8	5.8	7.1	92.5	4.7	5.4
California	426.0	43.5	11.4	465.0	39.0	9.2	488.0	23.0	4.9	518.0	30.0	6.1	570.0	52.0	10.0	650.0	80.0	14.0	752.0	102.0	15.7

More than 1,000,000 New Residential Customers During 1921



NUMBER OF NEW RESIDENTIAL LIGHTING CUSTOMERS PER YEAR, FROM 1915 THROUGH 1921, AND ESTIMATES FOR NEXT FIVE YEARS

DESPITE the large decrease in revenue from industrial plants in 1921 due to the business depression, it is an outstanding fact that the revenue from residential lighting customers has materially increased. The surplus energy resulting from the decreased industrial load has put the industry on its toes in an endeavor to acquire new load, and in this period of industrial depression the residential lighting customer has assumed a commanding position. The extent to which the residential lighting customer has been cultivated by the industry is clearly indicated by a survey which has just been completed by the ELECTRICAL WORLD.

Returns received from about 70 per cent of the electric light and power industry indicate that 1,001,700 new residential customers were added to the systems of the country during 1921. Of this number 70 per cent can be classed under the heading "old houses wired."

The accompanying diagram shows the comparative increases in residential lighting customers for the various years from 1915 to 1922 and estimates of increases during the next five yiears. In estimating the new residential customer for the years 1922 to 1926 inclusive, the results of a recent survey made by the *Building Age* have been used as a basis. This survey indicated that the equivalent of 1,328,629 new dwellings are needed at once. It appears to be the consensus of opinion that this house shortage will be eliminated by 1927, and the following building schedule has been assumed: 30 per cent of these dwellings to be constructed in 1922, 25 per cent in 1923, 25 per cent in 1924, 15 per cent in 1925 and 5 per cent in 1926.

United States Census figures indicate that an average of 270,000 dwellings were constructed each year from 1910 to 1920 to take care of increased population. By reason of decreased immigration, however, it is assumed that about 200,000 new dwellings will be built each year between 1921 and 1927 to take care of increased population. These figures must, of course, be added to the construction to eliminate housing shortage. It is believed that 90 per cent of these new dwellings will be wired for electrical energy. These new dwellings, however, are not the only source for central-station domestic lighting customers. The ELECTRICAL WORLD survey indicates that of the 1,001,700 new domestic installations added to the various systems during 1921, 700,000, or 70 per cent, can be classed as "old dwellings wired." There appears to be no outstanding reason why this figure of 700,000 old dwellings wired per year should not be maintained, and the figure has been assumed as applying to the years 1922 to 1926 inclusive.

The aggregate of these three sources of residential lighting customers gives an estimated total of nearly 5,000,000 new customers during the next five years, or a total of 13,854,600 residential lighting customers by Jan. 1, 1927. This estimated large increase in high-revenue consumers serves as a basis for prophesying prosperous conditions in the electric light and power industry during the next five years.

The tabulation on the opposite page gives a vivid story of the growth in residential lighting customers. The growth during the past year was at the rate of 13.5 per cent, and it appears that this rate of growth will be increased during the year 1922.

80,000-Volt Cable Being Installed in Italy

Review of Outstanding Features of Development in Underground Practice—Higher Cable Voltages—Kenotrons for Burning Out Cable Faults

BY PHILIP TORCHIO
Chief Electrical Engineer New York Edison Company

THE most remarkable development of the past year, one that will greatly influence future practice, is the use of 60,000-volt cables to supply power to all the Paris suburbs from the new 200,000-kw. Gennevilliers station. Fifteen feeders transmit the output of this plant, each feeder consisting of three single-conductor, paper-insulated, lead-covered cables installed in reinforced-concrete troughs buried in the ground. Another remarkably high-voltage single-conductor cable installation, namely 80,000-volt, is being installed by an Italian company. Since 1914 this company has had in operation nine miles of 50,000-volt single-conductor cable. This cable, which is used on the Catalan transmission line connecting with the Barcelona substation, has had only one failure, ascribed to electrolysis from stray currents of street railways. Two 40,000-volt cables have been in operation for about eight years in Turin, Italy, as underground substation terminals of overhead-transmission lines. However, on account of surges caused by grounds on the overhead lines apparently, numerous breakdowns occurred which necessitated the installation of isolating transformers. Incidentally the pressure was lowered to 20,000 volts.

In this country the New York Edison Company is about to install some 45,000-volt single-conductor cable, and other companies are studying its application.

The highest operating pressure for three-conductor cables is 33,000 volts. Several installations of such cable have been made in Europe and one has been made in Chicago by the Commonwealth Edison Company.

REDUCTION IN LOSSES

Marked improvements by several manufacturers in the reduction of dielectric losses in cables, through the substitution of mineral oil impregnation, have virtually eliminated one of the serious limitations to the safe operation of high-tension cables (over 10,000 volts) at temperatures exceeding 85-E degrees C., E being the pressure in thousands of volts. With the new high-tension cables of negligible dielectric loss, higher temperatures approaching 85 deg. C. for normal loads and perhaps as high as 105 deg. C. for overloads will become practicable and allowable in the case of moderately high-tension cables of 13,000 volts to 18,000 volts. For higher pressures it is questionable whether the elimination of dielectric losses will warrant a material increase in operating temperature because the lead sheaths will then expand, and not reset on cooling, leaving minute air spaces which may cause ionization within the insulation. This danger of ionization will be greater the higher the pressure. Further research is needed.

A large impetus has been given during the year to the study of safe operating temperatures for paper-insulated cables, and special investigations are being actively conducted in this country and abroad. Several papers were presented to the A. I. E. E. giving research and field data for cables in which the dielectric loss is low, tending to show that on "overload rating" such cables should be allowed 20 deg. C. margin over the normal rating of 85 deg. C. Great confusion in electrical engineering standardization has been created by too much generalization of the practice of "single rating" for almost all classes of apparatus, regardless of whether or not, with equal safety, this rating is more advantageous to the users than the old standard of "normal" and "overload rating." Several engineers believe the double rating should be applied to cables.

In the field of subway construction improvements have been made, first, in the study of duct temperatures by elaborate surveys; second, in subdivision of heavy trunk lines into separate banks of limited number of ducts, and, third, in artificial duct cooling, especially by manhole ventilation and sprinklers in an empty duct.

RELIEVING OVERHEAD CONGESTION

Further progress has been made in cable construction at substation terminals for overhead systems of distribution. The practice of running cables underground for several blocks from the substation to the overhead lines, thereby relieving all congestion of overhead wires at the substation, has been extended from the lower-pressure distributing lines to high-pressure feeders operating at voltages as high as 24,000. In some cases the three-conductor cables are brought to the pole where they join the overhead line and are spliced thereto by single-conductor leads each equipped with a pothead. Lately some companies have inaugurated the practice of running the three-conductor cables only part of the way to the overhead junction, using three single-conductor cables for the last 500-ft. or 600-ft. stretch. The insulation on the single-conductor cables is also materially increased to withstand lightning and surges, the relatively large inductive capacity of the cable being intended to absorb the steep wave-front discharges.

In direct-current distribution a novel departure has been introduced by the New York Edison Company in installing circuit breakers in the manholes (see ELECTRICAL WORLD, Jan. 7, 1921, page 30). The circuit breakers are operated automatically upon a burn-out of the cable to which they are connected, the operating impulse being given by the burn-out short-circuiting a pressure wire built in the cable as one insulated strand of the several strands of copper of the cable. The company has also been considering the installation of station circuit breakers on direct-current feeders in series with the present bus-selector switches, which are now manually operated, by a current sent over the pressure wire. Having in mind the desirability of automatic circuit breakers, the company is installing in some new substations, in place of switches, remote-control circuit breakers specially designed in pairs to act also as bus selectors (see ELECTRICAL WORLD, Jan. 7, 1921, page 32).

Another development in underground practice is the use, for the detection of cable faults, of a kenotron with special protective features to safeguard its operation. The units now available, of about 5 kva., are of too small capacity to always burn out the fault when detected. A much larger capacity kenotron than is now available would undoubtedly replace alternating-current outfits rated at 2,000 kva. and over.

Finally, the American Committee on Electrolysis has prepared an outline of the status of the electrolysis problem which represents the unanimous opinion of all delegates of the different associations on the committee, including the owners of underground structures, the A.I.E.E. and the United States Bureau of Standards.

Major Turbine Troubles Diminished

Troubles In Past Year Confined Largely to Blading, Lubrication and Vibration—Some Figures on the Growth in Turbine Sizes—Points of Interest Gathered from Foreign Specifications

FREEDOM from the bigger troubles that have marked the experience of the last few years in the turbine field is the feature of the past year both here and abroad. The tremendous growth of central-station loads in the last ten years has led to a demand for larger and larger units. Combined with this demand, the possible economies with large, high-speed turbines have operated to force a rapid development of large units, particularly in American practice. This has created a difficult problem for the designers, who have not only had to develop the designs but also to supply materials that could be depended on to stand up under the severe service demanded of the equipment. The further complications in material supply incident to the war conditions existing during the greater part of the last decade have probably both retarded the elimination of difficulties that would be normally expected and introduced some that under other conditions might not have appeared.

In natural exasperation at the failure of an important unit, involving a serious loss in the expense of repairs and, under the circumstances, a far more serious loss in the crippling of service, because spare equipment was not available, some operators have gone to the extreme of doubting the practicability of the large-size unit. In a few cases investigations to determine the feasibility of a large number of units of comparatively small rating scattered in a number of moderate-capacity plants for the handling of a transmission system have been made. There has also been some tendency for plant designers to "shy" away from the use of the larger-sized units that manufacturers are willing to supply and fall back on the units of 10,000-kva. to 20,000-kva. rating, with a tendency to keep to the smaller sizes within this limit. Two factors are involved in this tendency, the first of which is distrust of the larger units and the other the fact that there are comparatively few systems developed to a point where the larger units are economically the proper equipment, since with them too large a portion of the system load may be tied up in one unit.

There is a point in the percentage of total system capacity beyond which it is impossible to go in increasing the capacity of individual units without making it economically impossible to provide the proper reserve plant for the protection of service. It is possible that this factor has been a bigger one in operators' criticisms of the larger units than the physical difficulties involved in the design, manufacture and use of the machines. The physical difficulties that were more obvious were, however, a convenient as well as an easier argument to which to point in support of the operators' objections. The record of the past year affords hope that the causes of the annoying experiences of the past are coming rapidly within the control of the designer and the manufacturer and that the experience of all industry is merely being repeated, namely, that no difficulties, however formidable they may appear, are insurmountable when economic pressure is heavy enough to demand a solution.

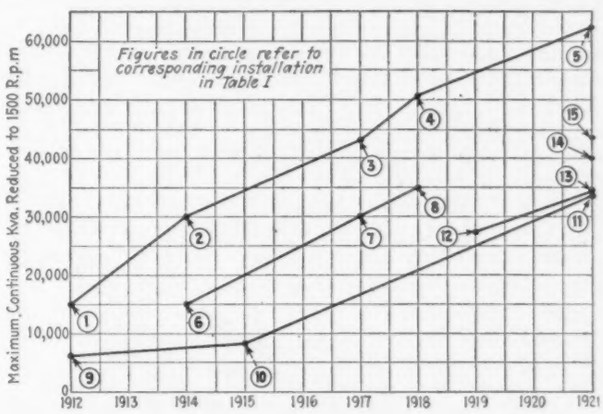


FIG. 1—GROWTH OF TURBINE RATINGS REDUCED TO 1,500-R.P.M. BASIS (K. BAUMANN, BRITISH I. E. E., APRIL, 1921)

GROWTH IN TURBINE RATINGS

In the *Proceedings* of the American Institute of Electrical Engineers for November, 1919, J. F. Johnson showed a curve indicating the present limits of the speed and power of single-shaft steam turbines. This curve was not intended to suggest practical limits of turbine capacities, either present or future, but the physical relations, with given operating conditions, that

TABLE I—CHARACTERISTICS OF SOME TURBINE INSTALLATIONS INSTALLED SINCE 1912
(K. Baumann, B. I. E. E., April, 1921)

No.	Manufacturer	Location	Year Installed	Rating in Kw. Maximum Continuous	Rating in Kw. Economical	Speed, R.P.M.
1	General Electric	Commonwealth—Fisk Street, Chicago	1912	20,000	15,000	1,200
2	General Electric	Commonwealth—Northwest, Chicago	1914	30,000	25,000	1,500
3	General Electric	Windsor power station	1917	30,000	22,000	1,800
4	General Electric	Commonwealth—Fisk Street, Chicago	1918	30,000	22,500	1,800
5	General Electric	Proposed practice for	1921	34,000	.....	1,800
6	Westinghouse	Interborough Rapid Transit, Seventy-fourth Street, New York	1914	30,000	25,000	1,500 750
7	Westinghouse	Providence—Narragansett	1917	40,000	33,000	1,800 1,200
8	Westinghouse	Commonwealth—Fisk Street, Chicago	1918	35,000	25,000	1,500
9	Parsons	Commonwealth—Fisk Street, Chicago	1912	25,000	20,000	750
10	Parsons	Underground, Lots Road, London	1915	18,000	15,000	1,000
11	Parsons & Met. Vickers	Lots Road, London	1921	18,000	15,000	2,000
12	R. W. Met. Vickers	Manchester Corporation	1919	22,000	20,000	1,500
13	Met. Vickers	Manchester Corporation	1921	27,500	25,000	1,500
14	B. T. H.	Rotherham	1921	30,000	25,000	1,500
15	Zoelly type	Paris (Gennevilliers)	1921	35,000	30,000	1,500

exist between speed and capacity with the materials available at the time.

The advantages of the steam turbine at high speeds from the viewpoints of reliability, thermal economy and first cost were declared by K. Baumann, chief engineer of the Metropolitan Vickers Company, Ltd., in a discussion of recent developments of the steam turbine before the (British) Institution of Electrical Engineers in April, 1921, to justify the efforts of the designer to obtain the maximum possible output at the highest possible speed, even though the high-speed alternator is less efficient and its first cost practically the same as that of the lower-speed machine and the advantages of the high-speed turbine are to some extent nullified thereby. Mr. Baumann called attention to the cost of the low-speed high-capacity machine, citing the case of a turbine built for the Rheinisch Westfalische Kraftwerke of Cologne, with a maximum continuous rating of 50,000 kw. and an economical rating of 40,000 kw., and declared that because of the cost of the set future progress will be toward increasing the output of 1,500-r.p.m. machines rather than developing 1,000-r.p.m. sets. The growth

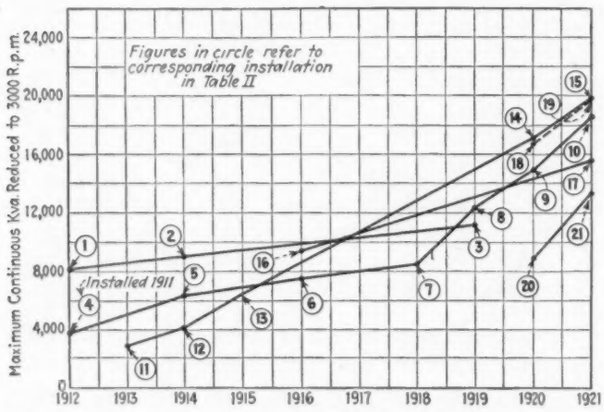


FIG. 2—PHYSICAL RELATIONS BETWEEN SPEED AND CAPACITY FOR SOME INSTALLATIONS

of ratings reduced to a 1,500-r.p.m. basis, as analyzed by Mr. Baumann, is given in Fig. 1. Mr. Baumann also discussed the tendency in turbines of even higher speed. Fig. 2 gives the result of his studies reduced to a 3,000-r.p.m. basis.

With the two speeds discussed it is interesting to note that the original tables from which the data were taken indicate clearly the difference in conditions in American and foreign plants. The data for the larger-sized machines were taken almost exclusively from American practice, while those for the smaller-size, higher speed equipment were taken from European practice with only one or two exceptions. These data seem to indicate clearly a trend toward the larger capacities and higher speed that has a basis in real demand. Both European and American reports indicate that units of large size are still on the design tables in preparation for a demand that seems to be expected as power requirements in the big industrial centers increase.

The discussions at the various meetings in England at which Mr. Baumann's paper was presented early this year brought out much the same feeling as to the practicability of the use of the large-capacity machines that was voiced by Farley Osgood in the November, 1919, discussion at the New York meeting of the American Institute of Electrical Engineers, when he expressed his feeling of relief that discussions were apparently being confined to an approximate limit of 30,000 kva. and the viewpoints of the operator were indicated as four in number, comprising (1) continuity of service, (2) capacity of unit out of service during periods of repair, (3) investment costs of units out of service or in reserve, and (4) length of time necessary to make necessary housekeeping repairs to the units. The reasons for the English viewpoint are different only in that English conditions apparently will not justify the use of turbines of such large capacity as American conditions permit. The limitation on sizes used would seem to be determined more by the economic conditions the plants must meet than by the ability of the designers.

RECENT OPERATING DIFFICULTIES NOT SERIOUS

The difficulties developing during the last year have been of the minor order and have been concerned largely with lubrication, packing and seals, blading and vibration. There seems to be a tendency toward providing an emergency pump on the oiling system to become automatically operative in case of failure of the pump on any unit in operation. This tendency brings out the need of standardizing oil pressure for the different sizes, types and makes of units. The formulation of standard specifications for turbine oil is receiving strong support as the result of difficulties from this source. There is also a strong demand for a simple method of testing lubricants, so that it will be possible not only to check the purchases but to keep track of the effectiveness of filtration and purifying equipment.

Some changes in the construction and material used for the dummy rings in the reaction type of turbine have been made to improve operation. The sealing of the high-pressure end of the casing is still engaging attention. The rather large amount of steam required and the difficulty encountered in utilizing it by turning it into a lower stage or through the feed-water heater are the principal troubles. That vibration during the starting-up operations may be promoted by the heating of the exhaust end, both by heat conduction from the high-pressure end of the casing and by steam passing through a leaking throttle valve, is the conclusion expressed by the committee on steam turbines and generators of the Association of Edison Illuminating Companies in its report this year. This, in the opinion of the committee, may be the explanation of many otherwise inexplicable cases of unsatisfactory operation, and the hope is expressed that a fuller investigation of the subject may be made for report at the next convention. Only a few cases of blading trouble have come to light, and these have been traced to either poor workmanship or poor materials during the war. The research work caused by these troubles has led not only to increased manufacturing precautions but to improvements in the alloys used by some of the manufacturers. Troubles with labyrinth packing in which the aluminum strips were corroded by free alkali in the steam have occurred in sufficient number to cause a substitution of brass.

IMPROVEMENTS IN DESIGN

The trouble with turbine wheels may be due to several causes, of which the most serious seems to be vibration and excessive stresses due to the uneven distribution of temperature. Excessive stresses due to centrifugal forces and to faulty design and materials fall in the class that is probably least difficult of control, because they are easy of detection by established methods. What happens in the wheels under running

TABLE II—CHARACTERISTICS OF SOME TURBINE INSTALLATIONS INSTALLED SINCE 1911
(K. Baumann, B. I. E. E., April, 1921)

No.	Manufacturer	Location	Year Installed	—Rating in Kw.— Maximum Continuous	Economical	Overload Rating in Kw.	Speed, R.P.M.
1	Westinghouse	Consumers' Power Co., St. Paul, Minn.	1912	4,500	3,500	4,500*	3,600
2	Westinghouse	Evansville Public Service Co.	1914	5,000	4,000	6,000*	3,600
3	Westinghouse	Sand Springs, Ltd.	1919	6,250	5,000	6,250†	3,600
4	B. B. C.	Schlettstadt	1911	3,000	3,000	3,750†	3,000
5	B. B. C.	For Swiss Federal Exhibition at Berne	1914	5,000	5,000	6,250†	3,000
6	B. B. C.	Geertruidenburg	1916	6,000	6,000	7,500†	3,000
7	B. B. C.	Heerlen	1918	6,800	6,800	8,500†	3,000
8	B. B. C.	Heerlen	1919	10,000	10,000	12,500†	3,000
9	B. B. C.	Amsterdam	1920	12,000	12,000	16,000†	3,000
10	B. B. C.	Proposed practice for 1921	....	15,000	12,000	15,000	3,000
11	Met. Vickers	Singer Manufacturing Company, Glasgow	1913	4,400	4,000	5,000*	2,400
12	Met. Vickers	Vickers-Barrow	1914	3,300	3,000	3,750*	3,000
13	Met. Vickers	Manchester Corporation	1915	5,500	5,000	6,250*	3,000
14	Met. Vickets	Liverpool Corporation	1920	13,750	12,500	15,625*	3,000
15	Met. Vickers	Proposed practice for	1921	16,000	12,500	16,000	3,000
16	Parsons	Newcastle Electric Supply—Carville	1916	11,000	10,000	.....	2,400
17	Parsons	Mersey Power	1921	12,500	10,000	.....	3,000
18	A. E. G.	Amsterdam	1920	13,500	12,000	16,000*	3,000
19	A. E. G.	Proposed practice for	1921	16,000	12,000	16,000	3,000
20	General Electric	Regina	1920	5,000	4,500	5,000*	3,600
21	General Electric	Proposed practice for	1921	7,500	....	.....	3,600

*For two hours. †For one-half hour.

conditions is a matter requiring research work that must be done under rather difficult conditions and requires time to work out.

Tests with rubber wheels, some rather thick, with heavy edges, and some thinner, with rather light edges, were discussed before the A. I. E. E. at New York in November, 1919, by W. L. R. Emmet. The edges were loaded with staples in a manner equivalent to the loading imposed by the turbine buckets. The wheels were marked out with a checkerboard pattern. Holes were also made in them, and the wheels were placed on a shaft which operated a high-potential spark at one point of its revolution in such a manner that, when operated in the dark, the wheel apparently stood still. The result was to reveal the forms a wheel tends to assume under various conditions. Among other things observed was the tendency of the edge of the wheel to work around like a crawling snake. This effect was observable only on the thinner wheels. The heavier ones with thicker edges did not tend to assume this motion. Other distortions that the forces at play tend to make were observable. The conclusions expressed by Mr. Emmet at that time was that all tendency to vibration, and particularly all tendency to injury through vibration, diminish very rapidly as the wheel is made stiffer.

Similar research work was outlined before the (British) Institution of Electrical Engineers in April by F. Samuelson, who added a description of the use being made by the General Electric Company at Schenectady of the oscillograph and other means of research to ascertain the effects of vibration, the conclusion being expressed that the cracks in the wheels are due to fatigue in the metal from repeated bending stresses and are not due to excessive centrifugal stresses. The discussion further asserts that tests with experimental wheels as well as wheels intended for production have demonstrated that even slight increases in the thickness of the web and outer rim of the wheel raise the critical speed of vibration so high that the wheel cannot be set in vibration even at relatively excessive velocity. The statement is also made by Mr. Samuelson that oscillograms taken from actual turbines with modified wheels show no vibration and that the trouble is now fully understood and taken care of in the later designs.

The recent report of the committee on steam turbines and generators of the Association of Edison Illuminating Companies favors definite action toward the preparation of a tentative dráft of standard turbine specifications, pointing out that standardization should be confined to matters affecting operating performance, central-station design, operation and maintenance requirements, and should not hinder improvement in design or construction of the equipment. Co-operation between the designer and manufacturer and the central-station designer and operator is emphasized as necessary, and full consideration must be given to all problems of manufacture and operation of the apparatus. The completion of the work in a short time is not expected, and when complete it is recognized that the specifications are subject to amendment as the art progresses.

Methods of standard testing are being developed by the committee on Power Test Code of the American Society of Mechanical Engineers.

The British Engineering Standards Association adopted standard specifications for steam turbines for electrical plants on Oct. 7, 1920, which were presented as Publication No. 132. In June, 1918, the Chambre Syndicale des Constructeurs de Gros Matériel Electrique and the manufacturers of Rateau turbines adopted a specification covering steam turbine and generator units that is being used in France until it can be revised so that it will be applicable to all contracts for steam turbines and generators. Both of these specifications have adopted the kilowatt continuous, full-load rating of the generator at a determined power factor as a basis for the rating of the turbine. The French specifications standardize the rating of single, compound or tandem turbines as shown in Table III.

TABLE III—FRENCH SPECIFICATIONS ON TURBINE RATINGS

Kw.	50-Cycle 3,000 R.P.M.	50-Cycle 1,500 R.P.M.	25-Cycle 1,500 R.P.M.
350	X	0	0
500	X	0	0
750	X	0	0
1,000	X	0	0
1,500	X	0	X
2,000	X	0	X
3,500	X	0	X
6,000	X	X	X
10,000	X	X	X
15,000	0	X	X
25,000	0	X	X

*X indicates that such units exist, 0 that they do not.

The British specifications require the turbine to deliver power at its rated speed and under the specified steam conditions sufficient to enable the generator to deliver an excess of 10 per cent over the rated load.

The French requirements are that the full kilowatt rating of the generator must be developed with a steam pressure variation 20 per cent, plus or minus, of the normal rated, a steam temperature variation of 10 per cent plus or minus of the rated normal, and a vacuum 2 per cent less than the normal. The maximum variations of pressure and temperature must not occur simultaneously.

For a condensing turbine running non-condensing the British requirements are 30 per cent of rated load at the rated speed, steam pressure—not less than 165 lb. per square inch (11.5 kg. per sq.cm.) absolute—and temperature for turbines up to a rating of 3,000 kw. The French specification calls for 50 per cent of rated load as rated speed, temperature and steam pressure for short periods only and in cases where it is necessary.

Both the French and British conform with the steam consumption ratings employed in American practice, namely, that the minimum consumption shall be obtained when the generator is operating at 80 per cent of its rating. The French specifications call for guarantees at 100, 80, 60 and 40 per cent of rated load, though, at the option of the purchaser and on specification in the contract, only those for 100 and 80 per cent shall apply. In the British specifications it is required that the average steam consumption be calculated to represent as nearly as possible the normal or average twenty-four-hour running conditions expressed in operation for six hours at 100 per cent, eight hours at 80 per cent, six hours at 60 per cent and four hours at 40 per cent. After determining the average steam consumption the averages are multiplied by three, four, three and two respectively and the sum is divided by twelve to represent the average steam consumption of the turbine under the normal operating conditions generally met with in central-station service, which are assumed as 73 per cent of the continuous full-load output of the unit.

The British specifications require the turbine to withstand during acceptance tests a speed of 15 per cent in excess of the rated speed. For speed regulation the British requirements are that with full load taken off or put on the permanent speed variation shall not be more than 3 per cent and the maximum momentary not more than 6 per cent. For 20, 40, 50, 80 and 100 per cent load variations the French specifications fix a variation for sudden load changes of 1.5, 2.5, 4, 5 and 6 per cent respectively and for gradual changes of 0.8, 1.3, 2.3, 3.3 and 4 per cent.

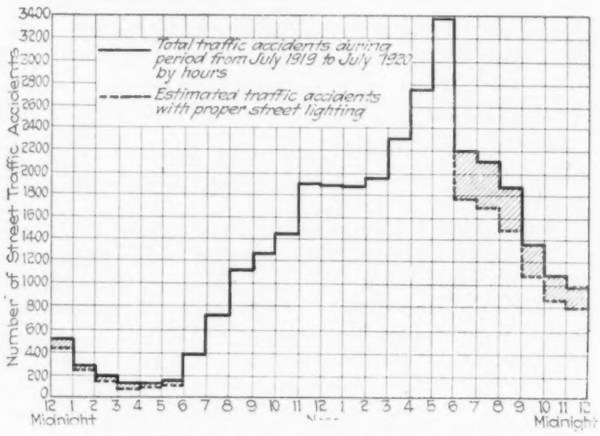
Both specifications require that the speed-control mechanism shall allow the turbine to operate up to 5 per cent above the rated speed when desired. Emergency trips shall operate when speed exceeds the rated speed by 10 per cent in the British and 7 to 10 per cent in the French. To test the operation of the emergency trip the French specifications require that the overspeed mechanism be provided with a means of overspeeding the turbine by manual operation.

Critical speeds in the British requirements shall not be within 30 per cent above or 35 per cent below the rated speed. Oil temperatures measured at the outlet from the oil bearings under normal conditions shall not exceed 140 deg. Fahr. The French specifications go into details in a number of items that concern dimensions, time and durations of acceptance tests, correction factors for steam and water variations during tests, and definitions of responsibilities that are not gone into in the British specifications.

Illumination and Traffic Accidents

THE seriousness of accident hazard on the streets of American cities and the prevention of accidents at night by more adequate illumination were discussed with considerable detail in a paper by Earl A. Anderson and O. F. Haas presented at the recent annual convention of the Illuminating Engineering Society at Rochester, N. Y.

The purpose in instituting the survey reported in this paper was to obtain, if possible, some definite measure of the value which should be attributed to the proper illumination of streets as a factor in the prevention of traffic accidents. A representative group of thirty-two



PROPER STREET LIGHTING WILL GREATLY REDUCE TRAFFIC ACCIDENTS

cities was selected, and a report of traffic accidents was requested covering a twelve months' period, in general, from the middle of 1919 to the middle of 1920. The total number of street traffic accidents reported in these cities during this period was 31,475, of which 9,534, or 30.3 per cent, occurred during hours of darkness. These figures, plotted by hours, are shown in the accompanying diagram.

To determine how many of the 9,534 accidents which occurred after dark would have been avoided had daylight or its equivalent prevailed, the accidents which occurred during the hours in the evening that are daylight in summer were compared with the accidents during the same hours in winter, when it was dark. It is evident from careful study that 17.6 per cent of all the accidents occurring at night must be attributed to lack of light during the winter months. Applying this percentage to the 9,534 accidents which occurred after dark in the thirty-two cities covered by the survey, it appears that 1,678 of them would have been avoided if there had been adequate illumination. These figures will be found charted in the accompanying diagram by hours.

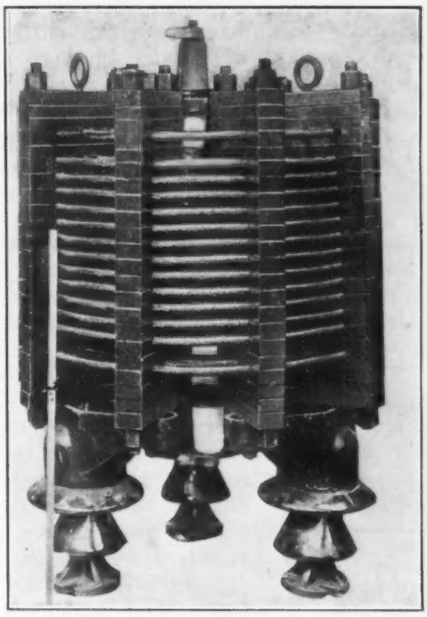
Assuming that the same proportion of day to night accidents which was found to exist in this survey holds in all cities, last year there must have been, out of a total of 10,640 killed, 3,223 deaths from automobile accidents at night, and 17.6 per cent of these, or 567, were directly attributable to lack of sufficient illumination. In addition to this loss of life, a similar computation shows that of the annual billion-dollar street accident loss the very substantial amount of $54,000,000 may also be attributed to lack of light. According to the census report, the total expenditure for street lighting in the United States is not in excess of $50,000,000.

Furnace Reactance Requirements Need Consideration

They Have Become Especially Important in View of the Growing Tendency to Use Higher Operating Voltages and the Importance Which the Public Utilities Are Attaching to Power Factor

By P. B. SHORT
General Engineer Westinghouse Electric & Manufacturing Company

A CERTAIN amount of reactance is desirable in an electric arc furnace circuit, as it provides a means for storing energy during part of the alternating-current cycle, when energy is returned to the circuit during a later part of the cycle and thus aids in maintaining the electric arc when the alternating supply voltage is actually reversing. Reactance is also of benefit in reducing the current surges, which are liable to be particularly severe, especially when melting down a cold charge of metal. The reactance of furnace circuits is becoming of more importance with the growing tendency to operate furnaces at higher voltages, for with higher voltages the current surges may be more severe and thus more objectionable.



FIGS. 1 AND 2—TWO TYPES OF AIR-CORE REACTOR FOR FURNACE SERVICE. THAT ON THE LEFT IS CABLE-WOUND AND RATED AT 250 AMP. FOR 13,200-VOLT SERVICE; THE ONE ON THE RIGHT IS WIRE-WOUND FOR 33 AMP. AND 12,000-VOLT SERVICE

During the melting period the resistance component of the furnace impedance can become comparatively small, especially when the metal caves in around the electrodes and produces virtually a dead short circuit across the electrodes. Under this condition the reactance is that part of the impedance which largely determines the resulting value of the current surge. In the extreme case, where the resistance of the furnace is considered at zero, the maximum value of current that can flow is inversely proportional to the percentage reactance. Thus, if the reactance is 25 per cent, the maximum sustained current cannot exceed four times the normal full-load value; likewise, for 40 per cent reactance the maximum current cannot exceed two and one-half times the normal value.

By running the busbars interlaid and spaced in the same manner as in coming from the furnace transformer the inductance can be kept to a minimum. If a higher inductance is desired, it can be readily had by running the bars uninterlaced and increasing their separation. In any circuit the inductance can be increased by increasing the separation between the outgoing and returning leads, for this creates a greater loop in the circuit and resulting greater magnetic flux. The presence of iron near the heavy-current conductors increases the inductance of the circuit, as iron forms a better path for flux than air does.

Regardless of whether 25 cycles or 60 cycles is used on a certain furnace, the inductance is the same. Reactance, however, does depend on the frequency and varies directly as the product of the frequency and inductance. It is usually expressed in this form: $X = 2\pi FL$, where F = frequency and L = inductance. From this it will be seen that a circuit having a certain amount of inductance has two and four-tenths times as much reactance on 60 cycles as it has on 25 cycles. From this fact it is at once apparent that if the desire is to keep the reactance low, it will be more difficult with a 60-cycle than with a 25-cycle power supply.

In some of the early electric furnace installations a large amount of reactance was placed in the circuit, and the furnaces operated at low power factors, the purpose being to limit current surges and maintain a fairly constant load, for at that time automatic regulators had not reached their present state of perfection. With the present-day regulators current surges are not so severe, for when the current starts to increase in value the regulators immediately act so as to correct this condition by raising the electrodes and returning the current to its normal value. Some of the early furnaces were operated at power factors as low as 70 per cent, whereas power factors as low as this are not required with regulators in order to secure a steady arc and satisfactorv

operation of a furnace. In most localities power factors as low as this are very undesirable, and many power rates now contain a clause whereby the energy or demand charge is increased if the operating power factor is below 85 or 90 per cent. With any of the commercial frequencies used there is no real reason why an electric arc furnace should operate at power factors below these values. In fact, the power factor of an electric furnace load can reasonably be expected to be higher than that of the ordinary induction motor load. Power companies are giving more consideration to the power factors of the connected loads and are making their rates so that a benefit is secured for high power-factor operation. For this reason no more reactance should be used in an electric furnace circuit than is necessary for satisfactory operation.

There is a growing tendency to operate furnaces at higher voltages, and while previously voltages around

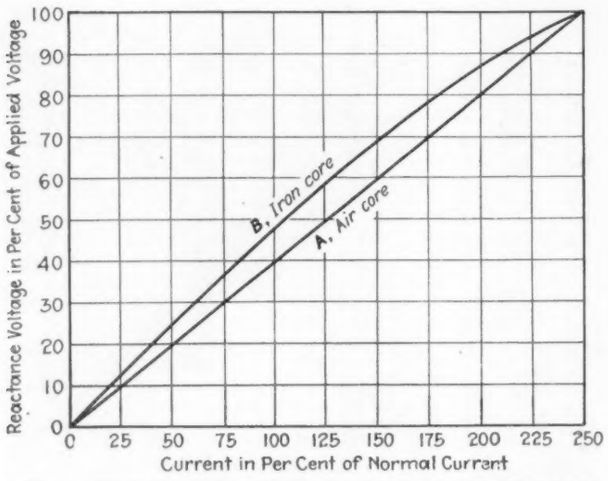


FIG. 3—CHARACTERISTIC CURVES OF AIR-CORE AND IRON-CORE FURNACE REACTORS

100 and 110 were used, voltages around 150 and even 200 are now being used. With this change to higher operating voltages, it is apparent that with a given furnace layout and inductance the percentage reactance will not be so high on 150 volts as it previously was on 100 volts. Likewise, if the furnace is equipped with a transformer of the same capacity for the higher voltages, the furnace current will be correspondingly less, which will decrease the reactive voltage drop and still further decrease the percentage reactance. It is because of the decreased percentage of reactance accompanying higher voltage operation that more consideration is being given to means of providing additional reactance in furnace circuits.

In a furnace recently changed over for operation at higher voltages a large iron-core reactor has been installed to insure stable operation at the higher voltages. While the furnace originally operated at 110 volts, it is now equipped with transformers which give secondary voltages of 220, 200 and 180 volts. In series with this transformer on the high-voltage side is placed a three-phase reactor, which permits obtaining additional reactance values of 42, 29, 16, 11, 7 and 4 per cent. The latter three values are obtained by placing the windings of the reactor in parallel. This is an example where it has been found desirable to use a separate reactor where higher voltage operation is employed, whereas on the lower voltage operation additional reactance was not found necessary.

It is often found desirable to provide additional reactance in the form of reactor coils because they can be cut either in or out of the circuit at will. When a furnace is first started up it may be found that a certain percentage of reactance gives most satisfactory operation, and this percentage can be readily obtained by merely connecting to the proper tap of the reactor coil. If at a later time the product being melted is changed or the operating voltage is changed, the percentage of reactance can again be changed to meet the new conditions. If the required reactance is all obtained in the transformer and leads, the reactance is fixed and cannot be changed to meet the new conditions. Likewise, where dual voltage operation is used, it often is found that a smaller amount of reactance is necessary when using the low voltage for refining than when using the high voltage during the melting period. Thus, by using separate reactors, at the same time the transformer taps are changed from high to low voltage the external reactor can be cut out of the circuit.

Most electric furnaces do not operate at a power factor greatly in excess of 92 per cent, and as this power factor corresponds to reactance of 40 per cent, it can readily be seen that maximum short-circuit currents will not be in the nature of ten times, as they may be in power plants, but more in the nature of two and one-half times normal current. It is for this reason that iron-core reactors can be used to advantage in electric furnace service. In any reactor it is essential that the reactor have close to a straight-line characteristic curve over its working range. That is, if the short-circuit current goes up to two and one-half times normal, the reactive voltage drop secured should also be two and one-half times normal. To secure this characteristic in an iron-core reactor, it is merely necessary to provide sufficient iron in the core, so that the iron will not become saturated under the maximum-current condition. Most iron-core reactors built for electric furnace service are provided with this amount of iron, and it is for this reason that their characteristic curve over the extreme working range is similar to that obtained with an air-core reactor. From Fig. 3 it can be seen that the reactive drop at two and one-half times normal current is the same for both types of reactors. However, as there is a certain amount of droop in the iron core characteristic curve, the reactive drop for normal current is slightly higher. After the iron becomes saturated there is very little increase in voltage drop with increasing currents. Thus, if curve B of Fig. 3 were extended beyond the 250 per cent current point, it would be found to droop very decidedly. If the short-circuit current ran up as high as ten times normal value, it would be out of the question to use an iron-core reactor, as the necessary iron cross-section area would make the cost prohibitive.

From this it will be seen that the selection of either an air-core or iron-core reactor depends largely upon the maximum current that will be encountered during a short circuit. For currents of the magnitude of ten times normal air-core reactors are always used, but where the current is in the nature of two and one-half times normal, iron-core reactors often offer advantages from a cost and installation standpoint.

Reactors may be placed in either the high-voltage or low-voltage side of the furnace circuit. The effectiveness of the reactors does not depend upon their location in the circuit. If placed in the high-voltage side, they are placed in the incoming leads between the line cir-

cuit breaker and the furnace transformer. If placed in the low-voltage side, the reactors are placed in series with the heavy current leads, between the furnace transformer and the furnace. The former location possesses an advantage in that the currents are much smaller on the high-voltage side than they are on the low-voltage side, and thus the leads running to the reactor can be smaller and are easier to install. If the reactors are provided with taps and tap-charging switches the advantage will generally lie with the high-voltage reactor. Except for very high voltages, where circuit-breaker costs are high, the tap-changing switches for the high-voltage reactor will be found more desirable than the heavy-current knife switches, which are required for tap changing with low-voltage reactors. Heavy-current knife switches require considerable maintenance, which often cannot be given around a furnace.

It has been mentioned that the primary requirement of a reactor is that it must have a straight-line characteristic curve over its working range. In this connection it can be mentioned that a reactor whose reactive voltage drop would go up at a rate even greater than in direct proportion to the load current would be very desirable. This would be the ideal form of reactor, for under normal conditions a high operating power factor could be secured, and still the necessary percentage reactance would be available when surges existed, so that the maximum current would be held at a fixed value. While no reactors having this characteristic have been built, some steps have been taken along this line.

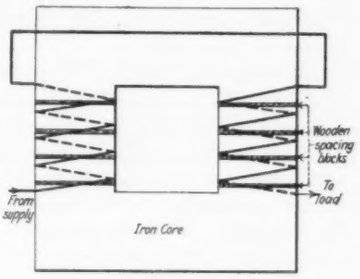


FIG. 4—RELUCTANCE OF MAGNETIC CIRCUIT INCREASED IN ONE TYPE OF IRON-CORE REACTOR BY WOODEN SPACING BLOCKS

If it is definitely known before a furnace installation is made that some reactance is going to be required in addition to the inherent reactance of the busbars and leads, this can often be taken care of by using a high reactance transformer. While normally furnace transformers are built with a reactance of from 4 to 8 per cent, it is possible with a slight increase in cost to obtain reactances as high as 15 per cent within the transformer. If it is known that this additional reactance is always going to be needed in the circuit, this method will be less costly than using separate reactors.

Since the voltage drop through the reactor does not subtract directly from the transformer secondary voltage, it is apparent that increasing the reactive component a certain amount does not result in an equal reduction from the resistance component. The energy available for the furnace is proportional to the resistance component of the transformer voltage. In the installation cited above it does not mean that 42 per cent of the available power is wasted in the reactor. The only real power loss in the reactor is that required to supply the copper and iron losses; as iron-core reactors are normally worked at low flux densities, the latter part of this loss is comparatively low. Even with the large reactor used in this case, when operating on the maximum-percentage reactance tap, the losses are the equivalent of approximately only 1 per cent decrease in the efficiency of the main furnace transformer.

Time and Position Ascertained by Radio

ALTHOUGH the most extensive field of radio transmission is the exchange of speech and information, there are also two lesser fields in which increasing use is being made of other possibilities of radio equipment. These are the broadcasting of time signals and the fixing of the relative location between a fixed station and a moving station, as, for example, a ship.

Three general methods of direction finding are in use, one in which the direction-finding equipment is installed in a fixed station on land, the ship being equipped only with the ordinary wireless outfit. The disadvantage of this arrangement is the confusion which results in case several vessels should require attention at one time. In a second arrangement the vessel is fitted with direction-finding apparatus and to certain fixed, or beacon, stations on shore is assigned the duty of sending prearranged signals on certain wave lengths at definite times during each hour. This arrangement has the advantage that any number of ships can obtain their bearings simultaneously from one station or set of stations. In the third method a rotating directional wireless beam having a fixed angular velocity is transmitted by a specially equipped fixed transmitting station. The rotating beam has a sharply defined zero position which passes through north and south at given times.

The importance of direction finding was emphasized during the war, thus stimulating the development of proper equipment. Recently further improvements have been announced and account is given by J. J. Bennett in a recent number of *Engineering* of operating methods and equipment including a simplified radiogoniometer. This is used in direction-finding stations having two aërials in planes at right angles to each other. These aërials are connected with two corresponding right-angle coils in the radiogoniometer, thus giving a resultant field in which a secondary coil with pointer attached indicates the direction of the sending station.

The ultimate value of direction-finding equipment will obviously depend upon its accuracy in operation. The article referred to states that under favorable conditions the maximum error with practiced operators is about 2 deg. Other reports on this subject, however, indicate errors of much greater magnitude. It appears that errors are larger at night than in the daytime and are greater for long than for short waves. An interesting account of these errors is given by Dr. E. Bellini in a recent number of the *Electrician*. He arrives at the conclusion that most of the errors which have been observed in direction-finding equipment are due to the horizontal portions of the sending antenna in conjunction with reflection from an upper conducting layer of the atmosphere, and that they may be reduced to negligible values by the use of simple vertical antennæ. If his theory and conclusions are justified, it would appear that direction finding may be placed on a definitely accurate basis. Of the several methods mentioned above the direction transmitting station with its rotating beam adaptable to all ships is apparently the most satisfactory. The only obvious disadvantage seems to be the special form of transmitting antenna required and its consequent cost. The probability of a wider use of direction-finding equipment is thus reduced to the question whether the service rendered is worth the necessary outlay.

Letters from Our Readers

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Venezuela as a Field for Electrical Development

To the Editors of the ELECTRICAL WORLD:

Having had the opportunity to observe and study economic and industrial conditions in the Republic of Venezuela during a residence of two years, more or less, I am prompted to call the attention of your readers to the extraordinary field that country offers for electrical exploitation and development from both a power and a supply-merchandising viewpoint. The coast line is almost a solid barrier of mountains, which, like all the mountains and hills of the republic, are literally seamed with cataracts and shallow, non-navigable rivers of sharp declivity. On the northward slopes of the mountains they flow, or rather tumble, to the sea, and on the southward slopes to the broad, fertile *llanuras*, upon which the capital city, Caracas, and the principal industrial centers are situated.

Where English, German and, rarely, native capital has essayed to "tap" these sources of power and of riches, the results have brought immediate and enduring profit. Stockholders in England and on the Continent of Europe have enjoyed comfortable dividends which have been earned for them by these waterfalls and streams.

Almost all of the Venezuelan cities—and, indeed, many small interior communities—are equipped with electric light and power plants. Many of these are operated from nearby waterfalls. It is estimated that there are in the vicinity of Caracas, the capital city, waterfalls capable of generating 30,000 hp. Of late years these have been availed of for a total production of no more than 9,000 hp. daily. The most potential of these are the falls of Naiguatá, which produce an available head of 1,020 m. and supply 515 liters per second, even during the dry season. They are capable, however, of a daily production of 8,000 hp. The Encantado electric light plant, also situated 16 km. from Caracas, generates 400 hp. daily in the rainy season and 100 hp. daily in the dry season. In Caracas, Maraçay, Valencia, Puerto Cabello, La Guaira, San Cristobal and Barquisimeto there are power plants employing steam as motive power.

Considering that 350,000,000 bolivars (about $70,000,000) is invested in the manufacturing industries of the republic, and that many of these have commenced to use electricity as a motive power only since the war, there are excellent opportunities for electric installation and the introduction of electric tools, machinery and other devices.

Two railway companies—one operating between Maiquetía, La Guaira and Macuto, on the coast near the port city named, and another operating between Caracas and Petare, a suburb of the capital—have since the war converted their rolling-stock and other equipment to electric operation and have electrified their lines, steam being no longer used, principally owing to the prohibitive costs of Cardiff coal briquettes for locomotive uses.

At no time in the history of the republic has the scarcity of fuel presented such a grave economic problem as at present, not only for power purposes in factories and other industrial establishments, but even for domestic cooking uses. Dr. Estéban Gíl Bórges, the Minister for Foreign Relations, has stressed the very great need existing in Venezuela for a greater volume and a greater variety of electrical apparatus and devices, particularly for household cooking purposes. He has outlined the exhaustion of fuel that resulted from the indiscriminate cutting of wood throughout the country, the government having been forced to restrict sweepingly the sources of fuel available at anything like economic cost to the capital city, Charcoal is used for cooking fuel in the 100,000 homes in Caracas, and with the reduction of wood supply to the very minimum, charcoal has become not only prohibitive in cost but scarce at any price.

Although the country is one of the world's producers of petroleum, because of the unsatisfactory physical qualities of the product for domestic fuel and the high cost of even crude oil—3 bolivars (60 cents) is a low price for "gas" per gallon in Venezuela—this has not proved to be the solution of the problem, although it has been the salvation of the automobile owner and dealer. Electric stoves and washing and kitchen apparatus designed to conserve and to save charcoal, some imported from the United States, but many more from England and the Continent, have begun to meet the economic and social needs of the larger urban populations.

Taking the ratio of area and population of Venezuela to our own country into consideration, the nothernmost South American republic appears to me to present, per capita, opportunities equal to those at home for the introduction and sale of electrically motivated instruments and household apparatus and devices.

Brooklyn, N. Y. HARRY CHAPIN PLUMMER.

Utility View of Commercial and Industrial Electric Heating

To the Editors of the ELECTRICAL WORLD:

Owing to the climatic and fuel conditions existing in California and judging from the inquiries being received, it is believed that a large load will be developed in this territory in the heating of buildings. This would be very desirable for the reason that a large portion of the California load is used in pumping water for irrigation, and as this is a summer load it would not coincide with the heating load, which would come in the winter. Judging from recent progress, it would seem reasonable that eventually the heating load could be made to surpass the motor load.

From the central-station viewpoint the heating load is more desirable than the motor load on account of the high power factor as compared with induction motors. With the exception of arc furnaces, welding machines and induction heaters, all heating applications operate at virtually unity power factor, while induction motors vary from 30 per cent to 90 per cent lagging power factor.

The time of day at which a heating load would be applied can probably be largely controlled by rates so designed as to encourage its use at the desired time.

Under present conditions, anything that could be added to the load between the hours of 10 p.m. and 7 a.m. should be entitled to a better rate than if it were on during the day and early evening. If it were possible to fill in the night valley, other rates could be reduced.

Pacific Gas & Electric Company, A. STRAUCH.
San Francisco, Cal.

Feasibility of Radio Communication to Mars Questioned

To the Editors of the ELECTRICAL WORLD:

I was much interested in a letter which appeared in your issue for Sept. 24 last from Nikola Tesla on the possibilities of telegraphing to Mars and hope you can find space for the following extract from Dr. James Erskine-Murray's book on wireless telegraphy. I think it will be interesting to your readers, especially since Dr. Murray's idea is that there is a conducting shell around the earth through which no electric currents can pass. In the chapter on the theory of transmission he says:

> The electrical properties of air at various pressures are well known. At 15 lb. to the square inch it is, except for extremely high voltages, a nearly perfect dielectric or non-conductor—that is to say, lines of electric force can travel through it without appreciable loss by dissipation of energy.
>
> At a low pressure such as exists at about 35 miles above the earth it becomes suddenly conductive, and at the pressure which must exist a few miles higher up its conductivity for high-frequency currents without electrodes is as great as that of a 25 per cent solution of sulphuric acid, so great, in fact, that a layer half an inch thick forms a complete screen through which electric waves do not pass.* At lower pressures, about 80 miles up, it becomes such a non-conductor as we know it in "hard" X-ray tubes, and farther up still, as perfect a dielectric as is known. There is a critical value of the pressure, which occurs at about 35 miles, below which height the air is practically a non-conductor, and above which its conductivity rapidly attains that of the best electrolytes.
>
> The non-conducting shell of air which surrounds the earth is therefore only about 35 miles thick—less than one-hundredth part of its radius—and is bounded below by earth, which has a resistance of about 6,600 ohms per cubic centimeter, or sea, with 373 ohms per cubic centimeter,† and above by a layer having a resistance of not more than 10 ohms per cubic centimeter. The upper shell then conducts at least 660 times as well as damp earth and nearly forty times as well as the sea.

To prove his contention Dr. Murray refers to the experiments of Mr. Tesla which took place in California, and at the end of the chapter on "World Wave Telegraphy," which he has copied in his book by the courtesy of your journal, he goes on to say:

> If Mr. Tesla's statement that the fundamental electrical vibration of the earth has a frequency of six per second is founded directly on experimental evidence, and not merely on theoretical considerations, it is a proof that the earth is surrounded by a conducting shell, for if this were not so its lowest frequency of variation would be seventeen per second, as mentioned by Professor Fitzgerald.
>
> We can also make an estimate of the height at which the conductive layer commences, for calculation shows that since a height of 60 miles corresponds to a frequency of ten per second, and a height of 6 miles to three per second, a frequency of six requires a height of about 35 miles, which is the same as that found from other data in Chapter XVI.
>
> Thus we should have an entirely independent proof of the existence of a conducting layer in the atmosphere, and of the fact that the dielectric with which we have to deal in wireless telegraphy is a layer of air about 35 miles thick between the two concentric spherical conductors.
>
> Professor Fessenden has noticed in working between America and Scotland that there are apparently two impulses received for every spark, and has suggested that the second may come the longer way round the earth. The interval between them is approximately a fifth of a second, which would indicate the height of the upper conducting layer to be about 30 miles. Professor Fessenden, however, does not agree with this explanation, but has not, as far as I am aware, suggested another.

I would like Mr. Tesla's opinion of the above, because if Dr. Murray's idea is right, then it is impossible to send messages outside this sphere, at least by wireless. Whether Mars can telegraph to us is another question as its inhabitants may have means which we have not.

Liverpool, England. CHARLES RETTIE.

*J. I. Thomson, "Recent Researches in Electricity."

†Brylinski, *Soc. Internat. Elect. Bulletin*, Vol. 6, p. 225, June, 1906.

Rudiments of Hyperbolic Functions Should Be Discussed Repeatedly

To the Editors of the ELECTRICAL WORLD:

In looking over the ELECTRICAL WORLD of Nov. 26, I was interested by the comments on page 1086 relative to Professor Kennelly's "Tables of Complex Hyperbolic and Circular Functions."

While it is desirable to have complete tables of such functions, it is still essential that the rudiments of hyperbolic functions be discussed repeatedly in their simplest terms until electrical engineers become so familiar with their meaning that they will have no hesitation about applying them, especially in making the final determinations of important power-transmission lines. Then they will demand tables to facilitate their computation.

Among some of even the most skillful electrical engineers as well as students, there persists a justifiable doubt as to whether the above-mentioned functions are hyperbolic or diabolic. The hyperbolic transmission-line formulas are concise and therefore elegant in the eyes of mathematicians. But safety razors are compact, yet they would not be used universally if each one came in a box whose lock was so intricate that hardly one person in a million could be induced to put forth the effort required to open the combination. So I was pleased that the reviewer emphasized the desirability of quoting transformation formulas and definitions.

Until convenient tables are accessible, the following relations seem most useful in interpreting the transmission-line formulas:

1. The transformation formulas

$$\sinh (u \pm jv) = \sinh u \cos v \pm j \cosh u \sin v$$

and $$\cosh (u \pm jv) = \cosh u \cos v \pm j \sinh u \sin v.$$

2. The definition

$$\sinh u = (\epsilon^u - \epsilon^{-u})/2 \text{ and } \cosh u = (\epsilon^u + \epsilon^{-u})/2$$

where $\epsilon^u = \log \epsilon^{-1} u = \log_{10^{-1}} (0.434294u)$ and $\epsilon^{-u} = 1/\epsilon^u$.

For, with these and a good table of common logarithms and trigonometric functions, any electrical engineer who knows how to perform the ordinary operations of multiplication, division and evolution of complex numbers is fully equipped to determine the performance of a transmission line in accordance with these exact formulas (E and I being vectors):

$$E_G = E_R \cosh \sqrt{ZY} + I_R \sqrt{Z/Y} \sinh \sqrt{ZY}$$

and $$I_G = I_R \cosh \sqrt{ZY} + E_R \sqrt{Y/Z} \sinh \sqrt{ZY}$$

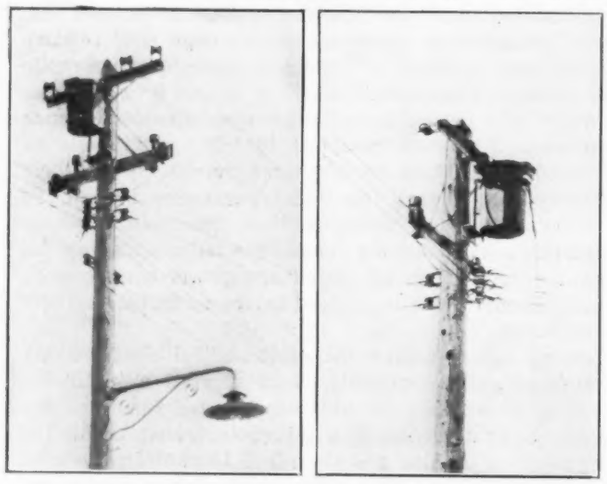
Stone & Webster, Inc., LLOYD N. ROBINSON.
San Francisco. Assistant Electrical Engineer.

Industrial and Station Practice

Installation, Operation and Maintenance of
Generating and Distribution Equipment and Economical Utilization of Electrical Energy
in Mills and Factories, Including Testing and Repair Methods

Economical Construction for Distribution Circuits

USE of galvanized-steel cross-arms and fittings has been found to pay good returns in the distribution system of the village in which the accompanying photographs were taken. The cost of the steel arms and fittings is a small proportion of the total cost of the system, and they have proved to be well justified by the permanence and lack of maintenance expense which characterize them. Two sets of cross-arms are used, angle irons for



GALVANIZED-STEEL FITTINGS AND SPOOL-TYPE INSULATORS MAKE NEAT AND PERMANENT LINE CONSTRUCTION

carrying the 2,300-volt primary lines and flat bars for mounting lightning arresters and transformer cut-outs. The angle iron measures 3 in. x 3 in. x ¼ in., and is cut into 48-in. lengths. The flat pieces are of ¼-in. x 5-in. steel and are 48 in. long. A large number of the pieces are made up at a time, and holes are punched suitable for mounting insulators and similar apparatus and for attaching braces.

Spool-type insulators supported on forks or racks are used throughout. For the primary wires the forks are mounted on top of the upper cross-arm by means of individual insulators on forks. It was found when constructing the lines that the wire could be pulled much easier than when pin-type insulators were used by resting it in the groove on the spool insulators, which either turn or allow the wire to slide without difficulty. Dead-ending is accomplished by means of the same type of insulator mounted upon the side of the angle-iron cross-arm. Primary cut-outs and lightning arresters are mounted on the opposite sides of the flat cross-arm, lower down on the pole.

Secondary conductors are supported by the same type of insulator held together in groups by means of racks made for the purpose. Series lighting circuits are dead-ended against each side of the pole by spool insulators.

This type of construction is quick to install, presents a neat appearance and lasts indefinitely. One system using galvanized-steel fittings has been in operation for nine years and today shows almost no depreciation.

New York, N. Y. FIELD EDITOR ELECTRICAL WORLD.

Care of Electrical Instruments

THE great majority of repairs on electrical measuring instruments are necessary because of two or three things which may have happened. The most common cause of failure of electrical instruments is the burning out of the hairsprings which control the action of the moving coil and also carry the current. This, of course, applies only to direct-current or dynamometer-type instruments. Such instruments will usually stand an overload of several hundred per cent, but when an ammeter is connected in as a voltmeter, or some similar mistake is made, where the current flowing is a great many times normal, it is usually the hairsprings which burn out first. There have been many attempts to put fuses in instruments to protect them against this sort of a burn-out, but they have not as yet been very satisfactory, and general practice is against their use. Of course, burn-outs of this sort are due to carelessness, and it merely takes a little thought before using an instrument in a circuit to eliminate this sort of accident. Where an instrument is put into a circuit and it is not known what current or voltage exists, an instrument of such a high range should be chosen for the first test that there will be no possibility of overloading it. The reading on the high-range instrument can then point out the proper range to be used for accurate reading, if the reading itself is low on the higher range and the proper meter selected.

It is a good rule to think twice before putting an instrument on any circuit and to check, if possible, the capacities which will be necessary against what is expected in the circuit. For instance, in testing a 50-hp., 440-volt, direct-current motor an ammeter of 100 amp. full scale should be used in any case at the start, and this should preferably be short-circuited with a heavy knife switch during the starting period; then if any heavy load comes on the motor, causing it to take full-load current, the ammeter will take care of the current and will not be burned out. If it is found that the circuit is carrying considerably less than 100 amp., owing to a very light load on the motor, a lower-reading ammeter may be substituted for the higher-range instrument so that the reading may have a higher degree of accuracy and show the results in a clearer way.

The moving elements of all instruments are swung on hard steel pivots resting on high-grade sapphire jewels. The bearing pressures on these pivots run quite high, and a little figuring will show them to be of the order of several thousand pounds per square inch. As might be expected, a severe jar or a drop of several feet on a

hard floor will cause these fine steel pivots, resting against the hard jewels, to bend or flatten and perhaps break off if the material is too hard to stand up properly. The net result of this is an increase in the friction of the instrument, which, of course, makes it unfit for use where fine readings are to be taken. The only remedy in this case is to replace the pivots.

Care should be taken that instruments are not dropped and that they are not subjected to jars. For instance, no hammering should be done on a bench on which instruments are standing, as the jar from this will cause the pivots to flatten and increase the friction error of the instrument.

By far the greater majority of instrument troubles are caused by improper handling and by carelessness. Instruments occasionally get out of adjustment because of some defect in manufacture, although with present methods such defects should be very few and far between. Accidents, of course, will happen, and the glasses in instruments are frequently broken when handled improperly in the stockroom or by workmen when assembling. As soon as the glass on an instrument is broken care should be taken to keep foreign material out of the inside of the instrument, as otherwise it may be necessary to rebuild the entire instrument because parts of the interior are damaged by particles of glass and by dust entering into the bearings.

Instruments should not be opened by the user. Almost all commercial instruments are now sealed with a wax or lead seal by the manufacturer, and if this seal is broken, the responsibility rests with the user and he is always charged for repairs. If the seal is unbroken, the manufacturer then knows that he has only overloading and rough handling to contend with and can proceed accordingly in the repair of the instrument.

JOHN H. MILLER,
Electrical Engineer.
Jewell Electrical Instrument Company,
Chicago, Ill.

A Labor-Saving Pole Yard

A LARGE pole yard requiring the services of only two men in addition to the two men required with each rig hauling poles represents real labor saving. This result has been accomplished by the Denver Gas & Electric Company in its pole yard, in which poles are

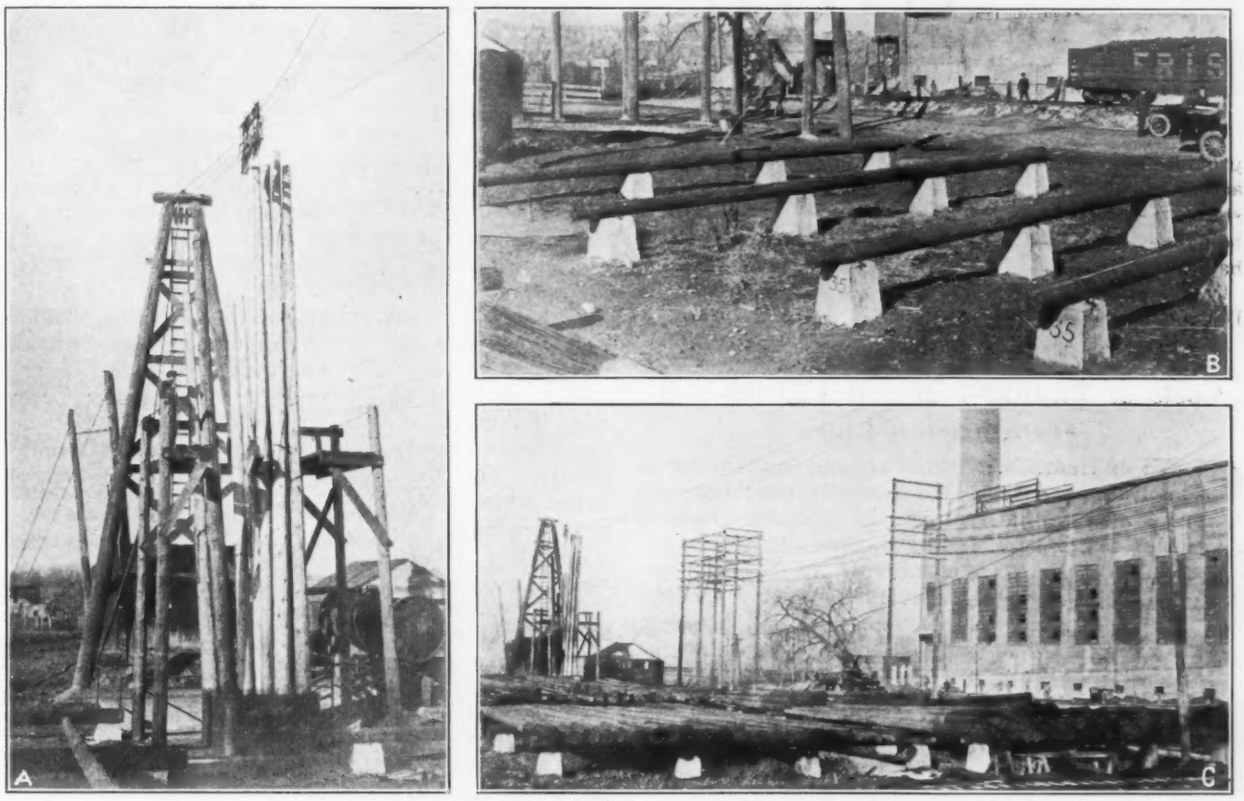


FIG. 1—ARRANGEMENT OF POLE STORING AND TREATING YARD
A—Several poles are dipped in the treating tank at the same time. B and C—Supports placed high enough to permit ready loading of poles onto trucks or wagons

shaved and treated as well as stored. The yard is 130 ft. long and consists of two sections with an aisle down the middle (see Fig. 2). An "A" frame is erected at each end of the yard to support the cable carrying the hoisting and handling equipment, which runs the entire length between the two halves of the yard. This equipment consists of an ordinary trolley-type rig operated by a motor-driven double-drum hoist without swinging gear. A 7½-hp. motor drives the hoist. The incoming cars are shifted under the trolley (at the right of the drawing), where the poles are unloaded and shaved. They are then carried to the treating tank (Fig. 1-A) and from there to the storage piles. Storage is on poles raised on concrete pillars to which they are fastened by steel straps (see Fig. 1-B). The poles are thus placed high enough to be rolled directly onto a wagon or truck if desired, though they are sometimes picked up and loaded with the hoist. The concrete

pillars are marked to show the length of poles stored in each section.

The treating plant consists of a tank 9 ft. in depth, with a steel storage tank and a pump for handling creosote oil in a concrete pit at the rear. The oil level may be maintained at any desired height and heat is

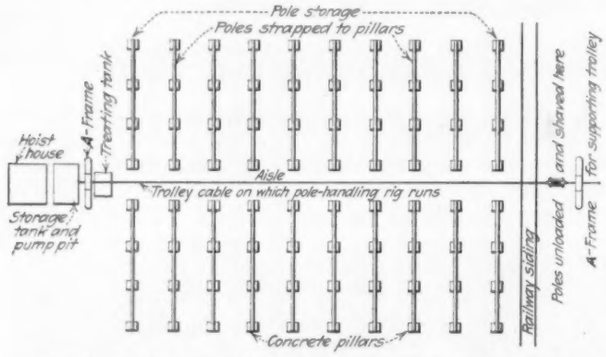


FIG. 2—LAYOUT OF POLE YARD ARRANGED TO SAVE LABOR

provided by steam pipes fed from the steam plant across the street. The two men in the yard unload, shave, treat and store the poles, the assistance of others being required only when poles are being loaded and hauled.

R. A. HAMMOCK,
Superintendent Electrical Distribution.
Denver Gas & Electric Company,
Denver Col.

Costs of 22,000-Volt and 13,000-Volt Transmission Lines

COSTS of transmission lines recently constructed in the South are given in the accompanying tabulation. Line *A*, which is probably the most typical example of standard practice, is a 22,000-volt, three-phase line having 21 miles of No. 4 and 4 miles of No. 2 copper conductors. The cost of this line in the spring of 1920 was $2,000 per mile. In the summer of 1921 this cost would have been about $1,800. Neither of the cost figures includes the expense of clearing right-of-way.

COSTS OF RECENT TRANSMISSION LINES

LINE A

Twenty-five miles through rolling country of a 22,000-volt, three-phase line with stranded copper conductors, 21 miles of No. 4 and 4 miles of No. 2, on 35-ft. chestnut poles having 36-in. "Bo-Arrow" arms and a $\frac{1}{16}$-in. static wire and with an average span of 150 ft. to 175 ft. Cost per mile, $2,000 (not including clearing). Line completed June, 1920.

LINE B

Sixteen miles through low, flat country of a 22,000-volt, three-phase line, with No. 6 aluminum conductor and a $\frac{1}{8}$-in. static wire and 40-ft. Western red cedar poles having two Washington fir cross-arms and with an average span of 225 ft. Cost per mile, $2,880 (not including clearing). Line completed January, 1920.

LINE C

About 4½ miles of extra-heavy line on rolling ground through railroad yards and towns and involving many crossings and turnings. Line constructed for 13,000 volts, three-phase, with 250,000-circ.mil aluminum conductors and a $\frac{1}{8}$-in. static wire on 35-ft. to 60-ft. chestnut poles having 36-in. "Bo-Arrow" arms and with an average span of 125 ft. Cost per mile, $4,400 (no clearing). Line completed April, 1921.

Line *B*, completed in January, 1920, was for 22,000 volts, three-phase. The higher poles, conductors of larger current-carrying capacity and other causes made the cost higher than that for line *A*. The cost per mile, not including clearing, was $2,880.

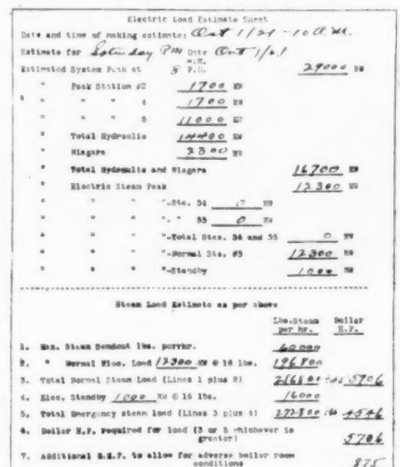
Line *C* carries a circuit through railroad yards and towns and has numerous crossings and turns. The conductor, however, is large—250,000 circ.-mil aluminum. The cost, therefore, is unusually high, $4,400 per mile in the spring of 1921.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Load-Dispatching System for Working Correct Number of Boilers

A LOAD dispatcher's chart which is of great help in keeping the proper number of boilers under fire has been developed by the Rochester (N. Y.) Gas & Electric Corporation. The purpose of the chart is to let the dispatcher know when more boilers should be fired up and when boilers should be banked.

In order that there shall be a sufficient number of boilers available to carry each day's peak load, an estimate is made on the day previous. This estimate tells how much boiler-horsepower will be required to carry the next day's peak. Knowing this, the dispatcher can say what boilers should be kept ready for service. In making such estimates the load dispatcher must determine both the probable peak load and the probable time of its occurrence. He estimates these from records of previous days on the same day of the week and at the same time of the year, making allowance for any special condition. From this total system load (in kilowatts) the load which can be carried by each hydro-electric station by an interconnection with the Niagara Falls Power Company and by means of any other outside connection is deducted. The difference is the electric load which must be generated by steam power. This gives the amount of steam peak load, and to this is added the kilowatts power which may be needed for standby service. This final result gives the total amount of power which will be required to meet the estimated maximum load on the steam-driven generators. These data are now translated into the number of pounds of steam required per hour. As the steam plant of the company produces steam for industrial and heating services, the first item of the steam estimate is the send-out steam in pounds per hour. To this is added the number of pounds of steam per hour required to carry the normal electric load at the peak. This is found by multiplying the kilowatts by sixteen, as it is estimated that 16 lb. of steam is required for 1 kw.-hr. The next step is to find out how many boilers are necessary to give this output of steam when the boilers are operating at the most efficient point. It has been found that the boilers are operating most efficiently at an average rating of 150 per cent, at which rating


Electric Load Estimate Sheet

Date and time of making estimate: Oct 11/24 - 10 A.M.

Estimate for Tuesday P.M. Date Oct 11/24

Estimated System Peak at 5 P.M. 37000 KW

" Peak Station #2 1700 KW
" " " 4 1700 KW
" " " 5 11000 KW
" Total Hydraulic 14400 KW
" Niagara 2300 KW
" Total Hydraulic and Niagara 16700 KW
" Electric Steam Peak 13300 KW
" " " "-Sta. 34 17 KW
" " " "-" 33 0 KW
" " " "-Total Stas. 34 and 33 0 KW
" " " "-Normal Sta. #5 13300 KW
" " " "-Standby 1000 KW

Steam Load Estimate as per above

		Low-Steam per Hr.	Boiler H.P.
1.	Max. Steam Sendout lbs. permit.	40000	
2.	" Normal Elec. Load 13300 KW @ 16 lbs.	126700	
3.	Total Normal Steam Load (Lines 1 plus 2)	246800	5706
4.	Elec. Standby 1000 KW @ 16 lbs.	16000	
5.	Total Emergency steam load (Lines 3 plus 4)	272800	6306
6.	Boiler H.P. required for load (3 or 5 whichever is greater)		5706
7.	Additional B.H.P. to allow for adverse boiler room conditions		825
8.	Total B.H.P. required 6531 B.H.P. to be operated		6531

Nos. 9-15-18-19-20-21

Signed [illegible] Load Despatcher Approved R.F.C.

J.C. Watch Engineer

SHEET FOR ESTIMATE OF DAY'S ELECTRICAL LOAD

they give 45 lb. of steam per hour per nominal boiler-horsepower. Therefore by dividing the pounds of steam required per hour by forty-five, the result obtained will be the boiler-horsepower required for carrying the normal load.

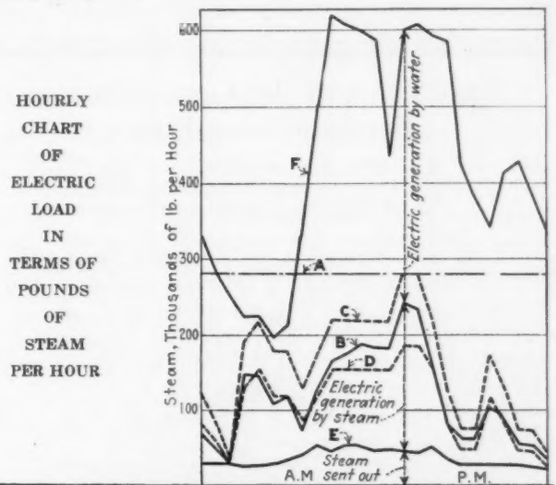
This gives the number of boilers necessary for normal operation, but it may be necessary to carry a higher load in an emergency. It has been found that 60 lb. of steam per boiler-horsepower may be generated each hour when necessary. To get the total number of boilers required in an emergency, the amount of steam sent out and the normal peak-load steam are added together and to this sum is added the amount of steam required per hour for the estimated standby electric load. The steam required for each kilowatt of standby load is found by dividing the kilowatt load by sixteen, as was done before. After these three amounts of steam have been added together the sum is divided by sixty, giving the emergency boiler-horsepower which may be required. After these two calculations have been made, whichever result is the larger is taken as the boiler-horsepower required for the day. From this the number of boilers to be used is determined, taking care to add additional boilers if the boiler-room conditions are so poor as to require it.

After making these tabulations, the line *A* shown in the accompanying cut is plotted on the load dispatcher's chart to represent the full load on all boilers which may be placed in service, working at an average of 60 lb. of steam per boiler-horsepower. This line is a limit beyond which the dispatcher cannot load the steam plant. In order to follow the course of the load throughout the day hourly readings are plotted, showing the system load in pounds of steam per hour. Curve *E* is the steam send-out and curve *B* is the electric load carried by steam superposed on the steam sent out. This curve *B* represents the steam load in pounds of steam per hour which the boilers carry. Even the hydro-electric load is converted to equivalent pounds of steam per hour and superposed on curve *B*, so that curve *F* represents the total system load.

To keep the boilers operating efficiently and yet to allow sufficient margin to pick up suddenly increasing loads, two guide curves *C* and *D* are plotted hourly. The upper guide curve *C* shows the available power which may be drawn from the boilers which are delivering steam. From tests it was found that about 60 lb. of water evaporated per boiler-horsepower was the maximum output. Therefore the curve is plotted showing 60 lb. of steam per hour for every boiler-horsepower carrying the load. The lower guide curve *D* is plotted for 40 lb. of steam per hour per boiler-horsepower. This is slightly lower than the most economical point, which is 45 lb. per boiler-horsepower.

The object of the chart therefore is to keep the steam-load curve *B* between the two guide curves *C* and *D*. If curve *B* falls below curve *D*, there are too many boilers steaming and one or more should be banked until there is need for more steam. Likewise, if curve *B* approaches or crosses curve *C*, the demand is such that additional boilers are necessary and should be started to steaming. Of course, judgment must be used; for instance, if it be known that a very heavy load is coming on the system, more boilers will be added without waiting for the curve to cross *C*, and line *E* represents steam furnished to customers as steam. Line *A* represents the full-load output of all boilers working at 60 lb. per boiler-horsepower.

At the bottom of the curve sheet is a table to show the total boilers under fire in each boiler house and also the boilers that are actually in steaming service, the difference between the two sets of figures being the boilers that are banked but not actually working. For example, on this particular day there were two boilers



		Time	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Boilers Available	Steaming	Old Station	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		New Station	1	1	0	3	3	2	2	1	2	3	3	3	3	3	4	4	3	1	0	0	2	1	0	0	0
	Total	Old Station	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		New Station	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

in the old house and four boilers in the new house under fire and ready for service. At 2 a.m., the low point of the day, there was only one boiler actually steaming and five banked, while at 2 p.m. the load required the working of all six boilers to produce the required amount of steam.

CHARLES E. HAGUE.
Rochester Gas & Electric Corporation,
Rochester, N. Y.

Electric Vehicle Operation Cheaper than Gasoline Truck

THE accompanying table comparing operating costs of electric and gasoline-engine vehicles summarizes the figures given in four tables of the article by Walter R. Metz in ELECTRICAL WORLD for Dec. 10, 1921, page 1173.

It is referred to as Table V in this article, from which it was inadvertently omitted. As will be seen, the daily cost of operation in all sizes covered was considerably less for the electric vehicle. In case of the 5-ton trucks the electric vehicle costs only one-third the cost of the gasoline-driven machines. In the 2½-ton and 1-ton sizes the operating expenses for the electric truck are respectively 45 per cent and 54 per cent of the expenses of the gasoline type.

COMPARISON OF ELECTRIC AND GASOLINE TRUCK OPERATING COSTS* PER DAY

Size Truck, Tons	Electric	Gasoline Range	Gasoline Average	Difference
1	$3.77	$5.33 to $11.36	$8.35	$4.58
1½	....	13.76	13.76	.....
2	....	5.15 to 7.83	6.49	.....
2½	4.34	..... 8.00	8.00	3.66
3	....	9.13 to 15.04	12.08	.....
3½	....	11.20	11.20	.....
4	5.74	....	.....	.....
5	4.97	18.49 to 11.30	14.89	9.92
6	....	....	.....	.....
7½	....	21.39	21.39	.....

*Exclusive of driver's wages.

Management and Policy

Embracing Central Station Commercial Organization and Management, Customer and Trade Relationships, Public and Financial Policies, Advertising, Selling and Service Methods

Two Views of the Central-Station Merchandising Policy

The Obligation of the Electric Light and Power Company to Lead the Way in Ethical Merchandising Practices

IN THE merchandising of electrical appliances the central-station company's attitude should be that of the leader in its territory according to C. S. Michel, sales manager of the Union Electric Light & Power Company of St. Louis. Pointing out that an electric light and power company has a duty to itself, its customers and the industry in showing the way in merchandising practice he says:

"The kilowatt-hour sales per kilowatt connected in the case of residence lighting is so sharply below that experienced in the other classes of electric light and power consumers that the residence business becomes a more or less undesirable load. We look on it as the duty of the central-station company to improve this condition and feel that we should strive to increase the use of electric energy in the home in a manner that will not add appreciably to our station and distribution expenses.

"Public utilities have the responsibility of serving the public and should so conduct their business that they do this fully, efficiently, economically and in a manner calculated to protect the interest of their stockholders, and the development of their market in all legitimate ways is consequently one of their important duties. It is our opinion that the majority evidence points to the fact that the maximum results in merchandise sales and consequently appliance consumption are achieved in those cities where the central-station company leads the way in the progressive merchandising of appliances; that in those cities the electrical development of the territory has been speeded up and the retail outlets for electrical merchandise have enjoyed a larger business than would have been the case had the utility been dormant.

"Our conception of our merchandising responsibility is that we should conduct that branch of our business with due regard to business ethics and the general welfare of the industry; that we should vigorously prosecute the sale of electrical merchandise for a profit, vigorously competing for every dollar's worth of the business offering on a fair and equitable basis."

W. S. Heald, manager of the commercial service department of the Duluth (Minn.) Edison Electric Company believes that the merchandising problem can be solved best by asking another question. He says:

"The question that always comes to my mind whenever this subject is discussed is this. Is there another manufacturer of any line that entirely throws away his sales department and leaves the building up of his business to outside agencies that have no interest in his welfare whatever and over whom he has absolutely no control? I believe that all will agree with me that there is no one so foolish as to do this, and yet that is exactly what the central station is doing when it leaves all sale of appliances to contractors, who in the final analysis have little in common with the central station company.

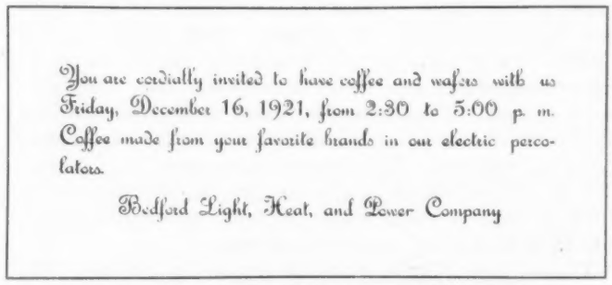
"I believe that the central station should merchandise appliances extensively and fully and that the methods pursued should be of such a high grade type that any electrical merchandising firm could compete on an equal footing. No legitimate retail merchant fears clean-cut competition of the right kind and I can see no reason why the electrical retailer desires to have the field to himself unlike any other line of business. If the central station will sell on a basis that any other retail merchant can compete, I believe that he will control the sale of these goods in a way that they should be controlled for the protection of his own interests."

An Experience in Coffee and Wafers

WHAT a courteous invitation to its customers to visit a demonstration in its office will do to promote good will and make appliance sales is found in the recent experience of the Bedford (Iowa) Light, Heat & Power Company. The invitation to "coffee and wafers" shown here was sent to all of the company's customers. How the idea was conceived and the results are most interestingly told by O. R. Toman, manager of the company, who says:

"We happened to have a very large stock of percolators. Christmas trade had scarcely commenced when one of our customers dropped the remark that the 'light company' never put out anything.

"It occurred to me that we could put on this percolator demonstration with seemingly no strings attached


You are cordially invited to have coffee and wafers with us Friday, December 16, 1921, from 2:30 to 5:00 p. m. Coffee made from your favorite brands in our electric percolators.

Bedford Light, Heat, and Power Company

INVITATION TO VISIT PERCOLATOR DEMONSTRATION

to it and at the same time not spend a great amount of money. The people came long before we were ready and *continued* to come and continued coming until after closing hours. The number of people who did not know that electric percolators even existed was surprising. No effort was made by the young ladies in charge to sell anything. Their instructions were to make the best coffee possible and show how the use of the electric percolator was better than the 'ordinary way.'

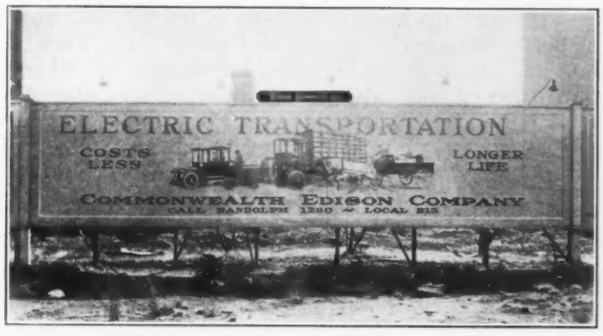
"Before the week was over, we were out of percolators.

We think it paid, not only from the financial side but from the inspiration of a better feeling toward the company. We have utilized numerous means for improving good will in this property, and as we look over the year's progress we are very well pleased with the results."

Billboards to Boost Electric Vehicle Transportation in Chicago

THE Commonwealth Edison Company has had a number of billboards erected at advantageous locations throughout the city for the express purpose of advertising electric transportation. The intention is to bring home to the public the thought that electric transportation, the electrification of trucking, is coupled up closely with Edison service.

These billboards are in sections of the city where they will be seen by those passers-by who will be most usefully influenced, namely, the executives and professional



ELECTRIC VEHICLE ADVERTISING IN CHICAGO

men, as it is men of this class to whom the electric passenger car appeals.

The posters used are in line with the Commonwealth Edison Company's policy of encouraging the electric vehicle load upon its lines. They measure about 50 ft. in length and 12 ft. in height and show an electric commercial truck, an industrial truck or tractor, and an electric passenger car in comparison with a horse-drawn dray.

Utility Service Defined

JUST what constitutes the service rendered by an electric light and power company is told by George S. Williams, general manager of the Central Maine Power Company, in an open letter to employees. Mr. Williams says:

"Personal friendship, between utility employees, officials and the public is essential to enable them to grow and operate successfully.

"Good public relations depend on satisfactory service. The term 'service' should be considered in a very broad sense. It is too often considered as applying only to voltage and continuity of supply. It should be extended in all cases to include the attitude of the utility representatives, their treatment of the public and their general conduct. A retail establishment, selling good material and not misrepresenting it, might in a narrow sense be selling satisfactory service, but in a broad sense the service to be satisfactory requires a congenial atmosphere and one conducive to the attraction of business to the establishment.

"The voltage on the lines of a public utility may be held within reasonable limits and there may be no service interruptions, but satisfactory service from the public relation's view includes also an attitude of officials and employees which makes the public glad to do business with the utility and certain of the justice which will be accorded individual complaints.

"Your job and my job can only grow as the company grows—and it is entirely up to you."

What Other Companies Are Doing

Detroit, Mich.—Miss S. M. Sheridan, vice-president of the Detroit Edison Company, has estimated that the company's business for 1922 will show an increase of 12 per cent over 1921. Miss Sheridan looks for small increases in January, February and March, better business in April, May and June, and a very marked increase in business from July to December.

Hammond, Ind.—The Northern Indiana Gas & Electric Company is helping the contractors in its territory in the wiring of old houses on existing lines by taking over partial payment contracts, thus financing these campaigns. This company is co-operating with the local electrical trade in every possible way in the development of co-operative publicity such as weekly electrical pages in local newspapers. Several meetings of the local contractor dealers have been held, at which the company's policy of "live and help live" was outlined.

Manchester, N. H.—Within the past year the Manchester Traction, Light & Power Company has installed several electrically operated refrigerators which have given absolute satisfaction. The cost of energy for operating these refrigerators has varied from less than one-half up to as high as two-thirds of the cost of ice. George H. Sander, commercial superintendent of the company, states that a vigorous campaign for refrigerating business will be started this spring in addition to special attention which will be given to electric range business.

Newark, N. J.—The net gain in lighting customers on the lines of the Public Service Electric Company in 1921 was approximately 44,000, or an increase of about 20 per cent over the number on the company's lines on Dec. 31, 1920. The company states that present prospects indicate a net gain during 1922 in excess of that of last year.

Spokane, Wash.—In this city, with a population of 105,000 people, the Washington Water Power Company is serving 22,000 residential customers. There are now approximately 2,000 electric ranges and water heaters connected to the company's lines within the city. The company expects to continue its work of popularizing these appliances during the year 1922 and expects to install within that period approximately 500 additional electric ranges.

St. Louis, Mo.—The Union Electric Light & Power Company is utilizing a rather unusual but perfectly logical adjunct in promoting the sale of its preferred stock to customers. The Clarkson Specialty Company, electrical manufacturers' agents in St. Louis, has been duly authorized to accept orders for and payments on sales of the company's preferred stock. Coming in contact as it does with men in the electrical industry who might not be reached by the regular salesmen of the Union Electric Light & Power Company the Clarkson company has been successful in making a number of stock sales in the electrical trade.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Motors, Generators and Transformers

Design of Induction Motors for Textile Service.—O. C. SCHOENFELD.—A description of the various types of drives and the motors suitable to these drives. The progress through the single-motor drive, the group drive and the individual drive is outlined.—*Electric Journal*, November, 1921.

Heating of Armature Coils in Slots.—OTTO BÖHM.—The author investigates mathematically the effect of ventilating slots in the armature laminations upon the heating of the copper and iron. Considering the conduction of heat across the laminas as very much poorer than along them, the problem of coils in a ventilated armature is reduced to a solidly embedded coil winding. A practical example illustrates the author's deductions. The investigations showed that it is very desirable to ventilate the armature by a large number of ventilating ducts and to resolve the necessary width of the iron into a number of narrow iron packages separated by six spaces.—*Elektrotechnische Zeitschrift*, Dec. 1, 1921.

Generation, Transmission and Distribution

The Hydraulic Turbines of the Walchensee (Bavaria) Plant.—G. TROELTSCH.—This article is a preliminary report of the hydraulic equipment of the unfinished Walchensee plant in Bavaria. Turbines of a total output of 168,000 hp. are being installed, a yearly output of about 160,000,000 kw.-hr. being looked for. It is of interest to note that in the same station two different types of turbines will be used, viz., four 24,000-hp., 500-r.p.m. Francis spiral turbines and four 18,000-hp., 250-r.p.m. Pelton wheels, both types operating under a head of about 195 m. The author illustrates his paper with drawings and photographs of turbines of a similar character and compares the Francis type with a 17,500-hp. wheel operating at 105 m. head at the Sorocaba station in Brazil, and the Pelton type with a 16,400-hp. double-runner wheel operating on 250 m. head at the Rjukamfes plant in Norway.—*Elektrotechnische Zeitschrift*, Nov. 24, 1921.

Electrical Characteristics of Transmission Circuits.—W. NESBIT.—One of a series of articles on this subject. It describes phase modifiers for voltage control. With alternating-current transmission there is a voltage drop due to resistance and one due to reactance. By employment of phase modifiers the direction of the resultant induced voltage may be controlled so that it will be exerted in a direction that will result in the desired end voltage. A method of determining what characteristics such a phase modifier must have is given in this article.—*Electric Journal*, December, 1921.

Canadian Automatic Converter Substation.—Refers to the first Canadian automatic converter station to be placed in successful operation. After a comparison with hand operation, the equipment, including the switchboard and wiring, is described in detail. The sequence of operation is then explained, with the occasion for the operation of the various equipment.—*Engineering (London)*, Dec. 2, 1921.

Copper-Cadmium Wire for Electrical Transmission.—W. C. SMITH.—Gives properties of such wire, the results of laboratory tests to determine the effect of annealing, and indicates the effect of including cadmium in the wire.—*Chemical and Metallurgical Engineering*, Dec. 28, 1921.

Hydraulic Power Development in South America.—THEODORE STEVENS.—A description of some features of the Victoria Falls and of the Falls of the Yguazù, along the border between Argentina and Brazil. The Victoria Falls has a drop of 400 ft., while the Yguazù has a spillway 10,000 ft. long, with 210 ft. drop and a further fall of 50 ft., making 260 ft. available.—*Electrical Times*, Nov. 24, 1921.

Traction

Electric Traction on the Mont Cenis (Italy) Road.—G. HULSCHINER.—This road is built according to Italian standards, as a three-phase system, operating at 3,300 volts and 16 to 17 cycles per second, and has a length of 84 km., which includes the 14-km. Mont Cenis tunnel. The electrification of the road was considered so urgent that there was no time to erect a power plant, but a contract was closed with the municipal electric supply department of the city of Turin to deliver 50-cycle, three-phase, 50,000-volt energy from its plant in Chiomonte. This power house limited the energy available to the railway to only 3,500 kw., which was not sufficient to cover the peak loads of the expected traffic. A clause was also inserted in the contract to avoid sudden load changes so as not to disturb the power supply of Turin. Of greatest interest therefore is the chosen equipment of the frequency-changing substation, erected near the road at Bardonecchia. Three frequency-changer sets were installed, consisting each of the following units, all on one shaft: One three-phase generator, 2,000 kva., 3,700 volts, 16.7 cycles, designed for 100 per cent overload for three minutes; one three-phase induction motor, 2,200 kva., 7,000 volts, 50 cycles, 500 r.p.m.; one three-phase commutator motor, 600 kva., 500 r.p.m. to 400 r.p.m.; two flywheels, 3.6 m. diameter, 0.66 m. width, peripheral speed 104 m., capable of delivering 750 kw. for one minute, while their speed slows down from 500 r.p.m. to 400 r.p.m. The commutator motor is a series motor connected in cascade with the main motor. During overloads the commutator motor together with the flywheels supports the output of the main motor. At the same time the frequency of the generator drops from 16-17 cycles to 13-14 cycles, which, however, does not affect the locomotives to any appreciable extent. Even during periods of very heavy peaks on the road very slight variations occur in the 50-cycle Turin supply system. This fact is shown plainly in a number of curves drawn by registering

instruments. Surplus energy from regenerative braking of the trains on down grades is primarily stored in the flywheels. If this energy amounts to more than what would correspond to a highest speed of 500 r.p.m. of the flywheels, it is absorbed in an automatically adjusting water resistor. The substation also contains three small water turbines of a total of 500 kva. to add to the power supply and to improve the power factor by over-excitation. A few details are given on the overhead construction of the three-phase road in the open stretches and the tunnel. Two comparative traffic graphs before and after electrification show that the electric trains save as much as forty-five minutes' time on a distance of 40 km.—*Elektrotechnische Zeitschrift*, Nov. 24, 1921.

Installations, Systems and Appliances

Present Status of Mine "Explosion-Proof" Electrical Apparatus.—W. PHILIPPI.—After comparing the rules governing the use of electric machinery in mines of Germany, Austria, France, England and America, the author describes motors, switches, lamp armatures and controllers for use in mines containing explosive gases. If motors are used which are completely inclosed the inclosure must be mechanically strong enough to withstand safely an overpressure of 8 atmospheres from within; or the motors may be ventilated through openings which are covered by two layers of metal mesh of a certain fineness or with a so-called plate protector consisting of a great number of closely spaced thin-metal plates. These devices cool any flame passing through them to a harmless temperature. A number of such constructions are illustrated.—*Elektrotechnik und Maschinenbau*, Dec. 4 and 11, 1921.

Mercury-Vapor Rectifiers.—The problems which have to be overcome before larger rectifiers become practicable are briefly outlined. The manner in which these problems have been approached so far is briefly discussed, and attention is called to the fact that mercury-arc rectifiers are now being built in units up to 500 amp. and 1,000 volts, while the near future promises 2,000-volt to 3,000-volt units. Comparisons with converters and motor-generator sets are made, and the performance of three rectifiers rated at 750 kw. and operating at loads ranging from one-quarter to 150 per cent normal rating is given.—*Beama*, December, 1921.

A Motor Installation in a Large Textile Factory.—J. T. RANDLES.—Description of the driving and distribution equipment in a modern electrically driven cotton mill at Rochdale, England.—*English Electric Journal*, Vol. I, No. 7.

Electrophysics and Magnetism

What Matter Is Made Of.—W. R. WHITNEY.—A brief discussion in semi-popular form of the electronic construction of matter as applied to every-day problems.—*Sibley Journal of Engineering*, January, 1922.

Electrochemistry and Batteries

Electrolytically Produced Calcium-Barium Lead Alloys.—W. A. COWEN, L. D. SIMPKINS and G. C. HIERS.—Illustrates equilibrium diagram and microstructure of barium-lead and calcium-lead alloys, pointing out that ternary alloys harden and strengthen on aging, are hard at moderate temperature, can be melted without change in analysis and constitute a very fine bearing metal.—*Chemical and Metallurgical Engineering*, Dec. 28, 1921.

Units, Measurements and Instruments

Research on Insulating Oils.—E. B. WEDMORE.—A study of the best form of spark gap for breakdown-voltage tests on insulating oils which leads to the conclusion that spherical electrodes should be employed and the recommendation that they should be 0.5 in. in diameter and 0.15 in. apart. Such electrodes appear to be very sensitive to the presence of contaminating particles of moisture and fiber and other material. They admit of an accurate calculation of the maximum stress to which the oil is subjected. The breakdown and preliminary sparking voltage were shown by means of a table which is given in the article.—*Electrician (London)*, Dec. 2, 1921.

BREAKDOWN VOLTAGES OF OIL BETWEEN VARIOUS SHAPES OF ELECTRODES

Average values observed (R. M. S.). B. D. = Breakdown. P.Sp. = Preliminary sparking.

Spacing, In.	½-in. Spheres.		½-in. Disks.		Needle Points		Point and Plate	
	B.D.	P. Sp.	B.D.	P.Sp.	B.D.	P.Sp.	B.D.	P.Sp.
0.025	3,570	2,940	.....	.....	.....	.....	8,430	7,075
0.05	5,712	4,354	6,510	4,680	11,950	8,140	12,250	8,256
0.075	.....	.....	8,950	6,220	.....	.....	.....	.....
0.100	13,185	7,583	14,500	7,380	17,760	13,500	15,980	11,810
0.15	19,530	11,140	19,060	11,070	22,090	16,300	.....	.....
0.175	.....	.....	.....	.....	.....	.....	19,660	14,680
0.200	27,160	15,340	27,900	22,080	24,400	18,750	.....	.....
0.250	.....	.....	.....	.....	26,730	20,390	23,340	17,360

Telegraphy, Telephony and Signals

Tube Sender at Königswüsterhausen.—H. THURN.—After a general explanation of the properties of electron tubes as senders, the author gives a description of the new 10-kw. sending station installed by the Telefunken company in the main radio station of Königswüsterhausen. The station can emit wave lengths of 2,000 m. to 9,000 m. from a surface antenna 125 m. high. Using a wave length of 5,250 m. the average antenna current is 50 amp. Six or eight sending tubes of 1½-kw. output each are used in parallel.—*Elektrotechnische Zeitschrift*, Dec. 8, 1921.

The Avalon-Los Angeles Radio Toll Circuit.—L. M. CLEMENT, F. M. RYAN and DE LOSS K. MARTIN.—Radio telephone service from Santa Catalina Island to the Californian mainland is described, including the mode of connection to the wire telephone networks at either end. Special points discussed are the narrowing of the side frequency bands due to modulation by means of filters, transmitter and receiver circuits, automatic alarm systems, through signaling systems and antenna and ground arrangements.—*Proceedings Institute of Radio Engineers*, December, 1921.

Auxiliary Features in Automatic Telephone Systems.—W. AITKEN.—In automatic systems the calling impulses are distorted and attenuated by the quality of the line just as the speech vibrations are. To avoid this trouble the author proposes an impulse-equalizing device which is shown in detail. With this apparatus the author claims that dial impulses are maintained practically uniform when transmitted over trunks of varying lengths.—*Electrician (London)*, Dec. 9, 1921.

Visual and Photographic Device for Recording Radio Signals.—CHARLES A. HOXIE.—The development of a visual and photographic recorder of a vibrator type. Recent forms of the instrument with its receiving-speed possibilities and behavior toward stray disturbances are discussed.—*Proceedings Institute of Radio Engineers*, December, 1921.

New Books

Reviews of the latest contributions to Technical, Industrial and Commercial literature of particular interest to members of the electrical industry

THE CODE AT A GLANCE. By Hubert S. Wynkoop. New York: National Association of Electrical Contractors and Dealers. 96 pages.

"The Code at a Glance" is a handy book of convenient size with durable binding, prepared by Mr. Wynkoop at the suggestion of the National Association of Electrical Contractors and Dealers. For twenty-five years Mr. Wynkoop has been at the head of the electrical inspection service of the city of New York, and no one appreciates better than he the need for a concise and easily consulted transcript of the National Electrical Code. He has rearranged in alphabetical order all the code requirements which it is essential for the contractor, the wireman, the estimator and the inspector to have constantly in mind.

WINNING THE PUBLIC. Second edition. By S. M. Kennedy, vice-president in charge of public relations and business development, Southern California Edison Company, Los Angeles, Cal. New York: McGraw-Hill Book Company, Inc. 148 pages.

This second edition of Mr. Kennedy's famous book on public relations has been expanded by the addition of two new chapters and material additions to other sections. It is unquestionably the most interesting, authoritative and useful book that has ever been published on the subject of public relations as affecting the utility.

One of the new chapters now opens the book and bears the title "Transforming Public Opinion." It presents from a broad viewpoint the general background of public relations as an element in utility operation. Because there still lurks in the minds of many a suspicion of big corporations, there is great need for constructive educational work that will build up a truer public appreciation of public service companies. The chapter analyzes the situation and its needs and describes the methods by which a "greater service department" may gradually overcome such prejudice and establish harmony in its stead. The other new chapter is entitled "Over-Complacency" and deals with the evils and dangers of self-satisfaction and the offensive air of superiority that sometimes marks the employee and, worse yet, the official of a utility. How this reflects against the company, through the complaint department and the district manager and in other ways, is described in detail.

The other chapters as revised cover the full range of this exceedingly broad subject. The reaction of different types and classes of people in their contact with the utility, how the public forms its judgments and their influence, the importance of definite informing and educational measures and how they should be organized and applied, and the benefits that come from the further refinement and perfection of good service into a "greater service" system are dwelt upon. The value of courtesy, cheerfulness and loyalty in the utility employee, the impulse of congenial contacts, the effect of proper display room and district office organization and the opportunities for service which different members of the staff may develop are treated in constructive detail. The pages dealing with the power of the art of conciliation, the danger that comes from over-complacency, the need for true commercial instinct and the benefit that can be made to come from cumulative co-operation are particularly interesting. In short, it is a textbook that is invaluable to every public utility man.

The author stands probably without a peer among electric light and power executives in his experience with the actual administration of public relations for a large utility corporation and in the scope and progress of his thinking and his teaching on this subject. Under his guidance the Southern California Edison Company has been a pioneer in the development of a high quality and spirit of service to the public.

It has been the purpose to present in "Winning the Public" a complete picture of the fundamental relationship between the public and the electric light and power company, and to provide by practical suggestion a code of policy and practice for the guidance of the utility executive in all his contacts with the people. By the most precise analysis and thorough detailed evidence the proper course of management and administration is made clear with a balanced judgment and helpfulness that make the book a source not only of information and good counsel but also of definite ideas and recommendations for use in the day's work. It is written with a clarity of expression and an orderly progression that make it easy and interesting reading.

RADIOTELEGRAPHISCHES PRAKTIKUM. By Dr. Ing. H. Rein. Third edition, revised and enlarged by Dr. K. Wirtz. 558 pages, 432 illustrations. Berlin.

A very compendious textbook on radio engineering, following the mathematical applications but with ample reference to construction, design and electrical connections. The book is not only well adapted for college classes but also for radio engineers and for electrical engineers interested in radio applications. At the end of the book there are several curve sheets, a good index and an extensive bibliography. The chapters of the book are lettered, and not numbered. They extend to and include the letter V. The book is particularly serviceable as illustrating recent German practice in construction and installation.

THIRD REPORT ON THE WATER POWERS OF GEORGIA. By B. M. Hall and M. R. Hall. Atlanta, Ga.: Byrd Printing Company.

The Geological Survey of Georgia has recently issued a most comprehensive report on the water powers of that state. This report, which is the third in number, is issued in co-operation with the United States Geological Survey. The greater portion of the report is devoted to stream-flow data collected at gaging stations in the state, but the report attempts also to give a dependable estimate of the magnitude of the water-power resources of Georgia, and a statement of developed water powers is included, describing with considerable detail the more important plants now in operation in the state. A number of profiles are given of important water-power possibilities, and there is also a map showing the location of the transmission and distribution lines.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

N. E. L. A. Convention Scheduled for Atlantic City, May 15-20

ANNOUNCEMENT has been made by the exhibition committee and the officers of the National Electric Light Association that the next convention of the association will be held at Atlantic City, N. J., May 15 to 20. An exhibition of an educational character will be held on the Million-Dollar Pier, and arrangements are being made for one of the most interesting and instructive conventions ever held. The Atlantic City Hotel Association has pledged the N. E. L. A. ample accommodations and every comfort.

Industrial States Will Lead in Building, Says Committee

MOST of the building activity of the coming year will be in the industrial states, according to a report just issued by the committee on statistics and standards of the Chamber of Commerce of the United States. In these states many new business buildings will be erected and there will be extensive programs of enlargement and alterations, but the prospects in the strictly agricultural states are not so favorable because of the low prices for farm products that have prevailed and the inability of the banks to make further loans. The three obstacles to building—high price of materials, high price of labor and difficulty of obtaining funds—continue, though conditions have improved greatly in regard to the first named and are expected to do so in the second with the approach of spring.

California leads the other states with respect to probable construction, the committee says. Prospects are also good in the East and the Central West, and many possibilities exist in the Southern States. Public buildings and additions to colleges and universities are planned in many sections.

Georgia Railway & Power to Complete Tugalo Development

ACTIVE construction work on the Tugalo development was begun in 1917, but owing to war conditions, was stopped until this week, when the Georgia Railway & Power Company announced plans for its completion. The location of the dam will be about 400 ft. below the point where the Chattooga and Tallulah Rivers unite to form the Tugalo. The dam will be one of the largest concrete structures in the South, 155 ft. high, approximately 130 ft. thick at the base, 850 ft. long across the top and containing approximately 225,000 ft. of masonry. The average annual output of the Tugalo plant will be approximately 130,000,000 kw.-hr. The present output of the Georgia Railway & Power Company is 300,000,000 kw.-hr. per annum, from which it can be noted that the Tugalo development will increase the total output of the system about 43 per cent over the present capacity.

The hydraulic equipment will consist of four 22,000-hp. waterwheels comprising the main units and a small auxiliary wheel of 1,000 hp. for station service requirements. The generating equipment will consist of four 12,500-kw. vertical-type generators directly connected to the waterwheels and a small exciter unit rated at 100 kw. Power will be generated at 6,600 volts and stepped up to 110,000 volts for transmission to load centers of the company. Transformer equipment will consist of two banks of 25,000 kw. capacity each, each bank in turn consisting of three 8,333-kw., single-phase, oil-insulated, water-cooled transformers. The low-tension switching equipment will consist of eight 6,600-volt oil switches and the high-tension switching will be accomplished by four 110,000-volt oil switches and a single 110,000-volt air-break, motor-operated switch. A transmission line about 3 miles long will be constructed to connect this station with the present 110,000-volt lines from Tallulah Falls to Atlanta. It is anticipated that the first unit will be placed in service in the early fall of 1923 and that the entire capacity of the station will be available before Jan. 1, 1924.

Nation-Wide Campaign for More and Better Business Launched

AT A LUNCHEON given in the Engineers' Club in New York on Monday by M. R. Bump, president of the National Electric Light Association, and attended by representative men of the industry, a nation-wide campaign for more and better business was successfully launched.

More than forty representatives of the electrical industry were present, including among them A. K. Baylor of the General Electric Company, A. A. Brown of the Westinghouse Electric & Manufacturing Company, S. E. Doane of the National Lamp Works, L. H. Egan of the Union Electric Light & Power Company of St. Louis, W. L. Goodwin of the Society for Electrical Development, C. H. Hofrichter of the National Council of Lighting Fixture Manufacturers, T. I. Jones of the Brooklyn Edison Company, J. W. Lieb of the New York Edison Company, E. W. Lloyd of the Commonwealth Edison Company of Chicago, S. Z. Mitchell of the Electric Bond & Share Company, W. H. Onken, Jr., of the ELECTRICAL WORLD, W. E. Robertson of the Robertson-Cataract Electric Company of Buffalo, E. W. Rockafellow of the Western Electric Company, C. J. Russell of the Philadelphia Electric Company, Frank W. Smith of the United Electric Light & Power Company of New York, C. Stone of the General Electric Company, Schenectady; M. S. Sloan of the Brooklyn Edison Company, James R. Strong, president of the National Association of Electrical Contractors and Dealers; F. S. Terry of the National Lamp Works, R. H. Tillman of the Consolidated Gas, Electric Light & Power Company of Balti-

more, L. R. Wallis of the Edison Electric Illuminating Company of Boston, Arthur Williams of the New York Edison Company, R. R. Young of the Public Service Electric Company of Newark, N. J., and P. B. Zimmerman of the National Lamp Works of Cleveland.

It was the opinion that the industry under the direction of the National Electric Light Association should rally around the slogan "More business—better business," and that every activity and agency should be enlisted in co-operation in an earnest and united effort to promote the continued development of the industry.

Frank W. Smith, ranking vice-president and chairman of the lamp committee of the association, gave an excellent epitome of the work which it was sought to accomplish. The impulse for the movement originated with the lamp committee. It was felt, however, that that committee could not best undertake directly as part of its activities the formulation and execution of a broad commercial activity of this kind, but that it would stand sponsor for such a movement and that the Commercial Section of the association should be looked to to carry on the work. In the discussion which took place in the executive committee meeting of the association last month it was emphasized rather forcefully that to some extent the sales departments or commercial organizations of member companies had been very considerably curtailed during the war; that since the war in many instances activities have not been resumed, and that the Commercial Section of the association was anxious and ready to get under way with renewed energy.

SUGGESTED ACTIVITIES

The plan proposed calls for some sort of an organization at headquarters under the general direction of Executive Manager M. H. Aylesworth, in active and direct contact with the Commercial Section, to direct and control the work.

Mr. Smith intimated that the activities of the headquarters organization might include (1) the general announcement of the executive committee's action, suggesting a nation-wide activity sponsored by the association; (2) direct-by-mail communication to central-station executives, explaining the value of the work for the coming year with definite suggestions for co-ordinating their activities not only with other central-station companies throughout the country, but with the different branches of the electrical industry; (3) the preparation of a concise prospectus setting forth in an attractive manner the several activities that might be undertaken in the different communities, sponsored and carried on by the several interests there established; (4) a traveling representative who would do the field work, explaining in detail the entire campaign to executives of the principal central-station member companies. This field activity might be carried on by and with the co-operation of the Society for Electrical Development under the general direction of the executive manager of the National Electric Light Association. In Mr. Smith's opinion a method could be found for consolidating the efforts of the two societies for this particular field activity.

Mr. Smith referred to the splendid work that the National Electric Light Association has done and the results accomplished during the past year through the good-will campaign that has been carried on as a co-operative effort with the manufacturing and other classes of membership in the organization.

President Bump spoke most enthusiastically of the opportunities ahead for the industry and particularly of the favorable financial conditions. In his estimation there is no central-station company in the country that has not a wide-open field to double its output in the next five years. There was every indication that the utilities would be able to finance any extensions necessary for the development of new business and that with a definite plan and the requisite enthusiasm and push the success of the movement was assured.

Talks of the same tenor were made by R. S. Tillman, S. E. Doane, E. W. Lloyd, J. W. Lieb, Arthur Williams, S. Z. Mitchell, R. R. Young and others. J. R. Strong pledged the support and co-operation of the National Association of Electrical Contractors and Dealers in the work, and W. E. Robertson, who represented the Electrical Supply Jobbers' Association, was most optimistic on the outlook. William L. Goodwin offered all the resources of the Society for Electrical Development in furtherance of the scheme, and the hearty support and good will of the manufacturers were indicated in talks by A. K. Baylor, A. A. Brown and F. S. Terry. Mr. Egan, speaking for the St. Louis Electrical Board of Trade, said he was so impressed with the opportunity that he would guarantee that that body would allot the entire time of a competent man to the work.

A steering committee was appointed, headed by R. S. Tillman, chairman of the Commercial Section of the association. The tentative committee at present consists, in addition to Mr. Tillman, of Frank W. Smith, S. E. Doane, W. E. Robertson, A. K. Baylor, Rex Cole, E. W. Lloyd, A. A. Brown, R. S. Wallis, A. J. Hixon, C. K. Nichols, C. E. Greenwood and F. B. Farmer. The committee has had several meetings since Monday and will announce its plans shortly.

Wisconsin Utilities to Meet in March

THE annual meeting of the Wisconsin Electrical Association, the Wisconsin Gas Association and the electric railway group of the Wisconsin Electrical Association will be held at the Hotel Pfister, Milwaukee, on March 22, 23 and 24. The following tentative program has been arranged:

WEDNESDAY, MARCH 22

Afternoon.—Transmission line, substation and distribution group; inductive interference troubles, high-voltage lines in cities, costs of lines, etc.; leader, G. A. Mills, Eau Claire. Electric railway group leader, W. G. Brooks, Chicago.

THURSDAY, MARCH 23

Morning.—Address by president and reports of officers and committees, including steam-road-crossing committee, street and interurban committee, legislative committee and safety code advisory committee.

Afternoon.—"How Rates Are Made," by Commissioner Lewis E. Gettle; "Taxation of Public Utilities," by E. J. Brabant of the Wisconsin Tax Commission; "The Wisconsin Public Utilities Bureau," by Franz Herwig, director.

FRIDAY, MARCH 24

Morning.—Auditing group; leader, C. E. Kohlhepp, Wisconsin Public Service Company, discussion on machine billing, etc. Safety group; leader, C. B. Hayden, Railroad Commission, explanation of new electrical safety and fire code. Sales group; leader, F. A. Coffin, Milwaukee; kilowatt-hours consumed by lighting and appliances, power-factor, coal and labor clauses, electrical merchandising.

Afternoon.—"The Field of New Business" (speaker to be announced later); rural-extension committee report, Chairman G. C. Neff; "Rural Line Studies," by Alvin Meyers and F. T. Singer, University of Wisconsin.

Motor Industry to Regain Vitality Quickly, Says W. A. Layman

IT REQUIRED "the greatest economic cataclysm of history," according to W. A. Layman, president Wagner Electric Manufacturing Company, St. Louis, to interrupt the rapid growth of the electrical industry of the United States. "Minor trade recessions of the last thirty years," Mr. Layman said to a representative of the ELECTRICAL WORLD this week, "simply impeded it for brief intervals. An industry so fundamentally contributing to civilization's progress is certain to regain its vitality promptly as the world swings back to normal living. President Bump, in his recent stimulating letter to the N. E. L. A. membership, says conditions now make possible the financing of immediate sound central-station expansion, and that the next five years will witness the doubling of central-station production. This means unquestioned prosperity for the motor industry. The year 1922 will be one of intense competition in general business, compelling the maximum possible efficiency of production. The electric motor is absolutely essential to industrial efficiency, and keen competition will help revive the motor industry. With all economic conditions steadily improving, courage in all business lines reviving, paralysis of initiative disappearing, fanciful social mirages dissolving into good old-fashioned common sense, I confidently believe 1922 will see a steady return toward a complete and greater prosperity in our industry."

President Bump's Optimistic Forecast

MILAN R. BUMP, president of the National Electric Light Association and chief engineer of the Cities Service Company, in reviewing the central-station industry of the United States for the past year and commenting on the outlook for 1922, said, recently:

"The electric light and power industry has come through the trying conditions of 1921 with a remarkable record of progress toward readjustment. While in certain industrial centers demands for power service fell off materially in the early part of the year, it is noteworthy that in almost every instance these losses were overcome before the end of the year. A large portion of the gains are, of course, attributed to the resumption of the industries previously served, but there has also been a marked gain in new customers. Domestic consumption continues to show gains and the field for electrically operated household appliances is constantly expanding.

"The change in the investment markets in the later months of the year has had a most beneficial effect, and for the first time in several years money is obtainable at rates which regulated utilities can afford to pay. The result is that a general program of expansion is now under way, and I am confident that 1922 will break all previous records for development of plants and systems.

"The fact that the electrical utilities have successfully come through both the war and the subsequent reconstruction period without an important failure has increased the standing of these securities as investments immeasurably. The coming year will be marked by many new and important bond issues to finance improvements, but a very large portion of the new funds needed will come from the sale of junior securities to the customers of the various local companies.

"The industry is not overbuilt for present conditions. This means that it must expand enormously to be prepared for the increased business which the gradual though unmistakable return toward normal industrial growth will demand of it. The electrical industry is progressing, and in my opinion 1922 will prove a banner year from every viewpoint, because the vision of the leaders of the industry is such as to lead it both wisely and aggressively."

Incandescent-Lamp Business Investigated by Lockwood Committee

ON JANUARY 6 the Lockwood legislative committee of New York began an investigation into the electric incandescent-lamp business. This committee has for some months been delving into the building trades industry and related associations and combinations of manufacturers, jobbers, contractors and dealers in New York, and has succeeded in exposing many offenders against the Donnelly anti-trust law and bringing about their indictment. A number of the combinations that have been exposed, representing in all probably 500 or more corporations and individuals, have disbanded their organizations and have in good faith resumed competition as the law requires. In turning its guns on the incandescent-lamp industry the Lockwood legislative committee signaled out the General Electric Company for its attack, and testimony against the company and its practices was given on Jan. 6 by Harvey Wilson Harper, head of the Miniature Incandescent Lamp Company of Newark, N. J.

Mr. Harper, who said that he was at one time a member of the National Electric Lamp Association, told how he was forced to sell his business, which on an investment of $169,000 netted him and his partner $20,000 a year each. As a condition of the sale he was given a position with the General Electric Company, so he testified, at $3,500 a year to manage his old plant. It was while he was conducting this plant—namely, the Howard Miniature Lamp Company—he testified, that the General Electric Company suggested the desirability of his becoming a licensee of that concern in order to avoid patent litigation. He said he agreed to do this and also to maintain the prices fixed by the General Electric Company. When he subsequently applied for a license he said he was refused. He thereupon went to Germany, where he obtained tungsten.

According to his testimony, the General Electric Company then offered to license him to make tungsten lamps. After that he bought tungsten filament from the company and canceled his Berlin order. He agreed to maintain a resale price based on that of the General Electric Company and said he was required to fix the price at which the jobbers were to sell the lamps to the retailer and the price at which the retailer was to sell to the public. When this particular method was declared illegal, Mr. Harper testified, it was abandoned and a new method involving sale by consignment was followed.

In addition to the Howard Miniature Lamp Company, Mr. Harper said that the Ferguson Company of St. Louis and the Independent Lamp & Wire Company were also forced to sell to the General Electric Company. When the General Electric Company took over his company and that of the Independent Lamp & Wire Company, in both of which W. C. Durant, the automobile promoter, was financially interested, he went to work for the General Electric Company, but subse-

quently resigned and bought the miniature-lamp business of the Independent Lamp & Wire Company and planned to manufacture miniature lamps under the patent owned by it. The witness said that when Mr. Durant got into financial trouble he sold the stock of the Independent company to the General Electric Company for $181 a share, although it was worth $300 a share. As one of the conditions of the sale of the Independent concern to the General Electric Company, the latter was required to give Harper a limited license for making miniature lamps. He said he received a license to manufacture $480,000 worth of lamps a year, but that nevertheless he had done a business of $1,400,000 in 1920. He also testified that he further disregarded the license provisions by selling for export.

Under examination by Samuel Untermyer, counsel of the Lockwood legislative committee, Mr. Harper said he negotiated with Mr. Burrows of the General Electric Company for a license and when the latter was asked why the General Electric Company would not grant Harper permission to do a larger business he answered "among other things that he was going to clip my wings."

Q.—You are questioning the right of the General Electric to interfere with your business? A.—Yes, sir.

Q.—Have you had any more intimations about wing clipping since this talk with Mr. Burrows? A.—Only when the production of this Ford lamp came up and Mr. Burrows made the statement that he would spend a million dollars to stop my making Tulite lamps, which, up to date, I still continue to make.

Q.—He hasn't spent the million yet, has he? A.—Not yet. Possibly he has started.

Q.—You think he has started? A.—Yes.

Then Harper explained that the General Electric cut his price and contracted to make 100,000 lamps for Ford, but the contract was canceled when the General Electric refused to guarantee the life of the lamp. The witness said he gave a guarantee.

LITTLE COMPETITION IN LAMP FIELD

Q.—There isn't much in the way of competition in the field, is there. A.—No, sir.

Q.—What has become of it all? A.—I think you ought to ask the General Electric Company that question.

Q.—Has it been absorbed or forced out? A.—One way or another.

Q.—What per cent of the total production of miniature lamps in the United States do you say the General Electric controls? A.—I would say 95 per cent.

Q.—That includes the Westinghouse, doesn't it? A.—Yes, sir.

Q.—How many concerns, with the exception of the General Electric, the Westinghouse and yourself, make miniature lamps? A.—Ten or fifteen small concerns.

Q.—Amounting altogether to less than 5 per cent, with yourself, of the whole business? A.—I think I would be correct in that statement.

Q.—Do you know whether your customers are being interfered with now by the General Electric by rumors that you are going to be put out of business this year? A.—Not that I am going to be put out of business, but a number of their salesmen have been to see my customers, advising them that, owing to my limited quota, I would not be able to take care of them.

Q.—You mean with your $480,000 quota? A.—Yes, sir, and suggesting to them that they sign up with the General Electric Company.

Q.—Is that very general now? A.—It is done pretty thoroughly.

Q.—If you were unlimited, how much business could you do? A.—I suppose I could do about $2,000,000 a year with my present capacity and finances.

Q.—I mean if you were free from these shackles and had the necessary financial backing and factory facilities. Could you do an unlimited amount of business? A.—I believe I could get my fair proportion of business.

Taking up lamp costs, Mr. Untermyer developed that a headlight lamp that cost 15 or 16 cents was sold by manufacturers to jobbers for 52 cents, and side and tail lamps for automobiles costing 6 cents to manufacture were sold for 28 to 35 cents.

Q.—Do you know whether there is a price agreement between the General Electric and the Westinghouse? A.—I know that they maintain the same prices.

Q.—Does the Westinghouse use the word "Mazda"? A.—Yes, sir.

Q.—Do the other licensees? A.—No, sir.

Q.—Do you mean to say that these other people who are making lamps under the license cannot use the trade name? A.—No, sir.

Q.—What is the idea of that? To make it look as if there were more competition, isn't it? A.—I would say so.

LAMP PROFITS CARRY OTHER LINES

Q.—Isn't it a fact that the General Electric is able to sell its other electric products on the back of these bulbs? A.—I would say so; yes, sir.

Q.—In other words, their competitive products are ridden to market on the back of this electric bulb? A.—I believe that is correct.

Q.—So apart from the direct profit there is a very large indirect profit? A.—Yes, sir.

The miniature lamps, Mr. Harper explained, are made by special machinery, the patents on which have expired. A large quantity of such machinery is made by the General Electric Company. Certain machinery, he said, was quoted by manufacturers at a much lower price than the price fixed by the General Electric Company.

A spot-welding machine for making lamps is sold by the General Electric for $160 and for $27 by others.

Q.—How do they manage to get six times as much for a machine? A.—Probably they do not want to sell the machine. That may be the answer.

Q.—So that a higher price on the machine would tend to restrict production, wouldn't it? A.—Yes.

Harper said that the General Electric Company was attempting to bar him from selling candelabra and decorative lamps, but that he was defying its order.

Mr. Untermyer took the witness through a history of lamp making in the last forty-five years and a description of the foreign patents used by American lamp makers as a basis for their work.

"Is it not a fact that the General Electric acquired these competing patents, bought them all in and thereby killed competition in the development of the electric lighting business by owning all these various styles of patents?" asked Mr. Untermyer.

"That would be my opinion," said Harper.

"That is what happened, isn't it?" counsel asked.

"Yes, sir," said Harper.

"The question is whether they can monopolize all the competing patents," commented Mr. Untermyer. "We will take that up with one of the other witnesses."

COMPANY DENIES MONOPOLY

The General Electric Company issued the following statement on Mr. Harper's testimony:

"The General Electric Company has no monopoly in the manufacture and sale of incandescent lamps. The company does a large part of the incandescent-lamp business only because the public demands the efficient tungsten lamp which is the result of the extensive work of the General Electric laboratories. These lamps produce about three times the light of the old lamp from a given quantity of current. In view of this, Mr.

Harper, who testified today, and certain other manufacturers prefer naturally to make this type of patented lamp rather than the older types which are not infringing.

"As to the charge that the General Electric Company is extorting $100,000,000 from the public for light bulbs, it is sufficient to say that in the year 1920 its profit from all of its manufactured products, including lamps, was $26,460,057.57. This profit was further reduced by the payment of federal taxes. The total receipts from the sale of lamps were less than one-quarter of the receipts from sales of all its manufactured products. The profit from the sale of lamps was higher than the average rate of profit on the rest of its business."

Probable Line of Investigation

On Monday the following inspired statement from the Lockwood legislative committee was issued as indicating the line of attack to be followed by Mr. Untermyer in his further investigation of the lamp business.

Accountants attached to the Lockwood legislative committee said that they had not been impressed with the statement issued by the General Electric Company in denial of the committee's charge that the company enjoyed a monopoly in the manufacture and sale of incandescent lamps from which it reaped enormous profits.

The company's statement said that its total profits from all manufactured articles, including lamps, for the year 1920 were $26,460,057. Samuel Untermyer, chief counsel to the committee, has charged a greater profit on bulbs alone.

When the committee convenes again Mr. Untermyer will embark on an analysis of the company's statement. He will try to prove that despite the decree of consent entered in the federal court at Toledo in 1911, by which the company agreed to abandon its control of resales of its products, the actual effect has been to tighten the monopoly through the establishment of the consignee system of distribution.

It was testified on Jan. 6 that 17.2 per cent of the business in lamp bulbs was allotted to the Westinghouse company by the General Electric. Allowing for a deduction of this proportion from the admitted profits of $26,460,057, as declared in the company's statement, Mr. Untermyer will analyze the figures on the basis of a report of the company's affairs for 1920.

This report has been submitted to the committee by Price, Waterhouse & Company, certified public accountants. It shows that, exclusive of the Westinghouse company's business, the net sales billed or total business of the General Electric Company for 1920 was $275,758,487.57. The total profits available for dividends are shown as $22,132,287. The total sale of bulbs was $57,892,580, and the net profit on bulbs is set down as $19,700,738, or 34 per cent on the total bulb sale. According to the figures, the difference between the profits on bulb sales and the profit available for dvidends is only $2,431,549, or slightly more than 1 per cent on the difference between the bulb sales and the total other business, which amounts to $217,865,907.

What Mr. Untermyer wants to know is why the company takes a profit of 34 per cent on one-fifth of its business and approximately 1 per cent on four-fifths of its business.

Before putting the officials of the General Electric on the stand the committee will call several other manufacturers in an effort to establish the theory that an enormous profit made in the manufacture and sale of standard size bulbs is concealed in the admitted profits of the company. It is Mr. Untermyer's contention that huge profits which pyramid in almost direct ratio to the size and watt consumption of the bulbs are reaped by the retailing agents, but that these in the end inure to the benefit of the company through providing a channel for the output of its other products.

The charge is made that the bulb business carries the load of the company's other output; that the consignees of the bulbs are allowed to collect a generous margin of profit on the bulbs as an inducement to carry other electrical appliances and accessories on which the retailer's margin is exceedingly narrow owing to the competition in this field.

Lamp Patents Sustained by Higher Courts

ALTHOUGH frequently attacked, the basic lamp patents of the General Electric Company have been sustained in the courts. The right of the company to license other manufacturers to make "Mazda" lamps under these patents has never been questioned. In order to safeguard the quality of the product, keep down the cost of distribution and maintain the various factories in economical operation, a system of consignment through agents, who for the most part only are persons engaged in the electrical business, is followed.

The General Electric Company owns the Just & Hanaman United States patent issued Feb. 27, 1912, for a tungsten filament for incandescent electric lamps. The filament, while more efficient than any other filament, was brittle and therefore unsuitable for many important uses. The research laboratory of the General Electric Company set to work to improve it.

Dr. Coolidge of the research laboratory promoted a line of investigation and research in tungsten metal that covered a period of several years and resulted in the invention of drawn tungsten wire, a ductile, practically non-breakable filament. This advance in the art was patented Dec. 30, 1913.

Dr. Irving Langmuir of the research laboratory of the General Electric Company during the course of experiments that he was making developed and invented the modern gas-filled lamp, which resulted in a patent being issued on April 18, 1916.

Patent Decisions

All of these patents have been sustained in the courts. Judge Mayer of the United States District Court for the Southern District of New York, speaking of the Just & Hanaman patent in the case of the General Electric Company against F. Alexander and N. Fabian and Alpha Laboratories, Inc., decided Oct. 29, 1921, said: "Notwithstanding the ingenuity and ability with which the Just & Hanaman American patent has been attacked, it remains where it was and where it should be—the embodiment of an impregnable invention of the highest order." The same judge sustained the Langmuir patent at the same time and had previously sustained the Just & Hanaman patent in the case of the General Electric Company against the Laco-Phillips Company. The Langmuir patent was also sustained in the case of the General Electric Company against the Nitro-Tungsten Lamp Company in the United States Circuit Court of Appeals for the Second Circuit on an appeal from a decision by Judge Mayer in the United States District Court for the Southern District of New York. The Coolidge patent contest was decided in favor of the General Electric Company as against the Independent Lamp & Wire Company, Inc., in the United States District Court, District of New Jersey, on June 29, 1920, Judge Morris saying: "The ductile tungsten filament has gone into general use and has in large measure, if not entirely, supplanted all other filaments, including that of Just & Hanaman, for incandescent electric lamps. It is less expensive to produce, yet it has far greater durability and utility than the squirted filament. It is a commercially new product of great utility, having properties and characteristics unknown to the natural and normal tungsten, or, in fact, to any other material." It is through these patents that the General Electric Company is able to control the manufacture and sale of "Mazda" lamps.

St. Lawrence River Report in Hands of the State Department

THE report of the International Joint Commission on the proposed canalization of the St. Lawrence River was submitted to the State Department on Jan. 6. A copy was forwarded to the Canadian government on the same date. The State Department expected to submit the report to Congress this week. Neither the International Joint Commission nor the State Department will give out any information as to the contents of the report, but it is probable that it will be made public immediately on its delivery at the Capitol.

Sleet Storm Study Gives No Basis for Safety Code Changes

AFTER a study of the damage done to power lines by the New England sleet storm in November, Bureau of Standards specialists see no reason why there should be any change in the requirements of the electric safety code. The code requires that construction be able to carry a half-inch of ice and be able to withstand a wind pressure of eight pounds to the square foot. Testimony regarded as reliable was taken on the ground by a representative of the Bureau of Standards to the effect that the storm was the most severe since the power lines had been erected.

The most important lesson to be learned from this storm, in the opinion of the Bureau of Standards men, is the necessity of extending the cleared area so as to reduce to the minimum the possibility of damage by falling trees and limbs. Fully nine-tenths of the damage to the New England power lines was from this cause. The bureau officials suggest that closer co-operation could be arranged among the power companies, civic officials and owners of abutting properties. Signal-line service could be safeguarded by similar procedure, although it is recognized that it cannot be carried out to the same extent.

The bureau's specialists see in results of this storm further proof that power lines should be kept up to the requirements of the code and that more attention should be given to angles in the line. The far-reaching effect of angle failure when it unbalances a heavily loaded line was demonstrated in many instances in the New England storm.

Engineering Council Discusses Licenses, Plans Ahead and Fetes Hoover

ROUNDING out a year of improved organization, substantial accomplishment and strengthened purpose, the American Engineering Council of the Federated American Engineering Societies held its first annual meeting at the Cosmos Club, Washington, Jan. 5 and 6, Dean Mortimer E. Cooley of the University of Michigan, president of the council, presiding. The officers were re-elected, the work of the past year reviewed and discussed, action taken on important matters of public and technical service, new financial arrangements put into effect, committees named, new policies sanctioned and old ones reshaped, and a broad and definite program outlined for the next twelve months. The council engaged in a long discussion of the principle of licensing or registering engineers and finally decided to direct the appointment of a committee to make a thorough study of the question.

The council made provision for a continuance of its national publicity work. It voted to continue support of the legislation for the relief of the United States Patent Office as embodied in the Lampert bill and to co-operate in the movement to prepare for cyclical industrial depressions and non-employment by resort to public works projects. Topographic mapping and the establishment of a Department of Public Works were other legislative matters in which the council decided to continue its support. Considerable discussion was provoked by the plan to establish a federation journal which would be sent to every engineer enrolled in the federation. The publicity committee made no recommendations and the council took no definite action.

On Thursday evening a dinner in honor of Secretary of Commerce Hoover was given at the University Club. The council presented to Mr. Hoover a copy of a resolution passed by it in which he was extolled for "the distinguished success which has followed him in his past services to his profession, his country and mankind."

One of the biggest problems confronting the country, Mr. Hoover thought, was that of electrification. He suggested that the engineers tackle this problem in the form of a waste survey. Such a survey, he said, afforded at this time great possibilities in the direction of effective leadership in the elimination of waste. The proposed superpower system along the Atlantic seaboard in the region between Boston and Washington was the starting point, he said, for prodigious development in consolidating the electrical powers of the country along national lines which would affect every village and hamlet, combine into superpower stations hundreds of thousands of minor electrical plants with millions of horsepower and result in tremendous savings to industry.

Water-Power Rights of New York State in Forest Preserve

AMONG the amendments to the water-power act of New York State that will be recommended by the Water Power Commission, as foreshadowed in Governor Miller's annual message, will be one intended to establish the disputed right of the state to enter upon the forest preserve and make contracts for water power.

The Democratic minority in the Legislature will, it is stated, support a bill based on the provisions of the hydro-electric bill of 1913 and calling for the expenditure by the state of $500,000 for a hydro-electric plant at Crescent Dam and Visscher's Ferry. This action will to some extent steal the Governor's thunder, he having recommended in his message the appropriation for this purpose of $1,000,000. The Democratic measure will carry with it the repeal of Chapter 499 of the Laws of 1921, which created the Water Power Commission to have general supervision over the granting of leases to state-owned water powers.

Boston Edison Offers Short-Term Securities Under 6 per Cent

ANOTHER evidence of the falling price of capital was given this week when the Edison Electric Illuminating Company of Boston offered two new short-term gold-note issues at a price to yield the purchaser less than 6 per cent. These issues were $4,000,000 of one-year 5½ per cent notes at par and $12,000,000 of three-year 5½ per cent notes at 99.15 and accrued interest, yielding slightly over 5.8 per cent.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Opposition to Daylight Saving in France Also.—The French Senate has passed a bill repealing the law setting forward the clocks one hour in the summer months on the ground that daylight saving worked injury to the farmers. On the other hand, a city councilor in Paris is urging that city to maintain daylight saving, declaring that its enforcement from March 15 to Oct. 25, 1921, had brought about a saving of 200,000 tons of coal, representing 100,000,000 francs.

John W. Lieb Will Lecture in Aid of Italian Milk Fund.—John W. Lieb, vice-president New York Edison Company, will deliver his illustrated lecture on "Leonardo da Vinci, the Master Mind of the Renaissance," at Carnegie Hall, New York, on Jan. 20. The lecture will be under the auspices of the American Free Milk and Relief for Italy, Inc., and the entire proceeds will go to this fund. Dr. Lieb's lecture is of especial interest to the engineering fraternity. Tickets may be procured from Frank W. Smith, 130 East Fifteenth Street, New York.

Shanghai's Wireless Towers.—Six towers each 1,000 ft. in height and with mechanical equipment equal in power to the great radio station at Bordeaux, France, form part of the plan for linking the Celestial Republic and the United States by wireless. The Shanghai station, which it is planned to erect within two years, will, it is said, be second to none in the world. Wireless communication through the interior of China will be facilitated by stations at Harbin, Peking and Canton. The building of the Chinese system is to be done by an American corporation, the Federal Wireless Telegraph Company.

University of Wisconsin's Course for Electric Metermen.—The program of the University of Wisconsin's school for electric metermen, to be held, as already announced, at Madison from Jan. 23 to Jan. 27, will be conducted through lectures and graded tests. One-hour lectures will cover the theory of electrical units, single-phase and polyphase meters, instrument transformers and watt-hour meters. Several illustrated lectures by representatives of meter manufacturers will be given on the care and adjustment of meters. The remainder of the time will be spent in the laboratory on actual meter testing. This course was planned in cooperation with the Railroad Commission of Wisconsin and the Wisconsin Electrical Association.

Duty of 20 Cents a Pound on Asbestos Ore and Fiber Asked.—The Association of Asbestos Mines of Arizona has submitted a brief to the Senate finance committee asking that a flat duty of 20 cents per pound be placed on all asbestos ore and fiber. The belief is expressed that the better grades of Arizona fiber, which go into the yarns upon which the manufacturers receive a protection of $168 per pound, cost at least 30 cents per pound more to prepare and deliver than does the fiber produced by Kaffir labor, while the so-called Arizona No. 2 fiber costs at least 20 cents per pound more to deliver than does the African product.

Petersburg, (Va.) Plant Nearing Completion.—Within the next few weeks the hydro-electric plant being erected on the Appomattox River for the Virginia Railway & Power Company will be completed and Petersburg will be independent of outside sources for its electric power. The new dam across the river is complete and work on the plant is being pushed. The plant will cost approximately $75,000 and will generate about 15,000 kw. a day. It is being built on the site of the old power plant of the same company. Petersburg consumes about 60,000 kw. per day, and the plant now in operation there produces about 45,000 kw., the remainder coming from Richmond and Norfolk. The new plant will make this unnecessary.

Rural Development in Utah.—Utah farmers enjoy the comforts of electrical conveniences to a greater extent than do the farmers of any other state in the Union, according to a report of the United States Department of Agriculture which was read recently at a meeting of the agricultural committee of the Salt Lake Commercial Club. Utah heads a list showing the percentage of farms in the various states which use gas and electricity. The table shows that 11,125 Utah farms, or 34.4 per cent, use either gas or electricity. Massachusetts is second on the list with a total of 28.3 per cent. While 30,519 farms in California are benefited, this is only 25.9 per cent of the total number of farms, and that state ranks third.

Pacific Gas & Electric Company's Properties Valued at $119,000,000.—At a rate hearing before the California Railroad Commission it has been brought out that the reproduction cost of the system of the Pacific Gas & Electric Company of San Francisco, estimated on the hypothesis that the system could have been constructed in five years prior to June, 1921, is $119,834,886. The historical cost, based on actual expenditures as shown by the company's records, is set at $94,354,976. Both totals include the Sierra & San Francisco Power Company, which is being operated by the Pacific Gas & Electric Company under a fifteen-year lease. These valuations are for the physical and tangible properties and do not include such items as franchises, water rights and working material.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Pennsylvania State Association of Electrical Contractors and Dealers.—The annual meeting of this association will be held in Allentown, Pa., on Wednesday, Feb. 15. Among other events there will be an "electrical industry dinner" at 6 p. m.

Engineers' Club of Philadelphia.—On Tuesday next, Jan. 17, at 8:30 p.m., well-known bankers and engineers of Boston, New York and Philadelphia will address a joint meeting of Philadelphia engineering bodies on the financing of large engineering projects. At the weekly luncheon on the same day L. W. Wallace, executive secretary of the Federated American Engineering Societies, will speak on "The Engineer and National Problems."

Iowa Engineering Society.—The three-day convention of this society to be held in Sioux City on Jan. 17 to Jan. 19 will be divided into a number of engineering sections. At the mechanical-electrical section meeting, on Jan. 18, Charles F. Schoonmaker, chief engineer of the Quaker Oats Company, will present a paper on the proper distribution of power costs and A. B. Campbell, electrical engineer of the Iowa Railroad Commission, one on the function of the commission in the development of transmission lines.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Cleveland, Jan. 14; Pittsburgh, Jan. 21; Chicago, Jan. 27; Birmingham, Jan. 28; Philadelphia, Feb. 4.

Indiana Public Utility Association—Bloomington, Ind., Jan. 14.

American Institute of Consulting Engineers—New York, Jan. 16.

Western Association of Electrical Inspectors—Chicago, Jan. 17-19. (For program see issue of Dec. 17, p. 1243.)

Iowa Engineering Society—Sioux City, Jan. 17-20.

American Society of Civil Engineers—New York, Jan. 18-19.

American Society of Heating and Ventilating Engineers—New York, Jan. 24-26.

A. I. E. E. Section Meetings—Baltimore, Jan. 20; New York, Jan. 27; Salt Lake City, Jan. 27.

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 26-27.

Lighting Fixture Dealers' Society of America—Milwaukee, Jan. 30-Feb. 2.

New Mexico Electrical Association—Albuquerque, Feb. 13-14.

Pennsylvania State Association of Electrical Contractors and Dealers—Allentown, Feb. 15.

American Institute of Electrical Engineers—Midwinter convention, New York City, Feb. 15-17. (For program see issue of Jan. 7, page 51.)

National Meter Committee, N. E. L. A.—Springfield, Ill., Feb. 15.

American Physical Society—New York, Feb. 25.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Secondary Demand for Mine Hoisting.—In valuation proceedings to fix electric rates for a gold dredging company supplying power for mining operations, the Idaho Public Utilities Commission decreed that a secondary demand for power for hoisting purposes is a proper charge, since the consumer receives the benefit, for which he should pay, and the utility must reserve excess energy for the use of the consumer whenever needed.

Reasonable Extensions of Service.—A rule requiring electric companies to furnish free service connections and a free line extension not to exceed two spans for each consumer was held by the Illinois Commerce Commission to be reasonable in the case of the Centralia Gas & Electric Company, and the utility was ordered to refund to its consumers money collected in violation of this rule. A public service company enjoying a monopoly in a municipality is charged with the responsibility of furnishing electric service in the territory where it is authorized to operate, the commission said, and in the discharge of its lawful duties as a public utility it should provide means of supplying the reasonable needs of individual applicants as they arise from time to time.

Water Rights as an Element in Valuation.—In adjusting the electric rates of the Tomahawk Light, Telephone & Improvement Company, the Wisconsin Railroad Commission made these observations in regard to the value of water rights: "The water-power value should not be considered as the total value of the water power for sale or other purposes. Our engineers find that at present not over one-third of the total firm power of the river is being utilized by the electric department. We cannot include the value of the unused portion in a property value on which the utility is entitled to a reasonable earning at present. For this reason, if we were to fix a value on the total water power belonging to the company, an apportionment of this value between operating and non-operating property would be required. Instead of doing this we have endeavored to determine a reasonable value for the water power used for utility purposes in another way. Our method has been to set a fixed value per kilowatt-hour for all the energy delivered at the switchboard and to obtain the water-power value by capitalizing the difference between the energy value and the costs (including the fixed costs on the utility's physical generating property) to generate this energy."

Municipal Rate Deviations Criticised.—Complaint made to the Wisconsin Railroad Commission against the charges made by the Bloomer municipal electric plant led the commission to say: "The evidence discloses that under its ordinance the village actually eliminated the discount feature from the commercial lighting schedule and that about the first of 1921 it commenced adding the demand charge to the energy charge for installations of less than 20 hp., instead of using this charge as a minimum bill only. There can be no doubt that these deviations result in an increase in revenue to the utility, and under the law we do not feel that the utility is justified in deviating from a standing policy with regard to rates (even though a literal interpretation of the rates on file might warrant such change) without resorting to a formal proceeding. We might therefore order a return to the rates charged prior to the unauthorized changes. However, in this case the interested parties have indicated their desire to have the commission fix rates consistent with the costs of service and this we will attempt to do."

Depreciation Reserve in Its Relation to Continuous Efficient Service.—Reversing a decision of the former commission holding that the reasonableness of telephone rates should be determined upon the basis of property in the local area, the existing New York Public Service Commission has declared that rates should be considered on the basis of the company's statewide activities. In the course of its finding the commission said: "A public utility is under a special and unique obligation to put back in its business and in its structural property every item which becomes necessary from time to time to insure that the consuming public shall receive the most efficient service both in quality and extent. In fact, it must continue to furnish the same service during its life which it does when it is new, and theoretically at its high-water mark of efficiency. This responsibility, it is needless to say, is a special one in that it does not rest on the ordinary business concern. So that it is well said, 'The value of the service of a utility is not measured by the unexpired service, but by the unexpired service plus the additions necessary to furnish the required service.' And in viewing utilities we should regard them as theoretically capable of continuous operation at the capacity mentioned. That is, utilities must maintain intact their capital investment, and when rates of depreciation are estimated and set up in accordance with rules, well defined and tested by experience, the actual sums standing to the credit of depreciation reserve are to be regarded as having been paid by the ratepayer to insure continuance of the required service."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Assessing Damages Caused by Right-of-Way.—In sustaining damages assessed against the defendant in Foley vs. Iowa Electric Company because of the construction of a high-tension transmission line across the plaintiff's land, the Iowa Supreme Court held that neither the overruling of objections to hypothetical questions where the verdict showed that the answers given to these questions were considered of no value nor the admission of cross-examination of defendant's witnesses in regard to the difference as to danger between insulated and uninsulated wires and between substantial and less substantial erection was prejudicial to the appellant company. (185 N. W. 13.)*

Bill to Enjoin Rates Fixed by Municipality Must Allege Them Unreasonable.—Affirming the dismissal of a suit in equity to enjoin electric and water rates (Bell vs. Kaye), the defendant being the owner of the utilities but the rates having been fixed by the Mayor and Aldermen of Booneville, the city served, the Supreme Court of Mississippi held that inasmuch as the appellants, although they attacked the ordinance as void, did not allege that the rates complained of were unreasonable or offer to pay a proper rate, they were not entitled to relief, even though the ordinance was not in conformity with statutory requirements, the ordinance not being the foundation of the right of the defendant to collect charges for service furnished. (89 So. 110.)

Commission's Power Over Equipment in Public Streets.—The City of Yakima, Wash., brought suit against the Department of Public Works (formerly the Public Service Commission) to compel it to order the Pacific Power & Light Company, which has a water department, to remove a wooden main from the street. The Supreme Court of Washington, holding that the condition of the main was not such as to make its removal necessary, refrained from passing on the legal question whether the commission has jurisdiction to determine controversies between a municipality and a public service corporation in regard to the character of the equipment the latter must maintain on public streets in order, in the language of the law, "to promote the security or convenience of the public or employees." (201 Pac. 778.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

Andrew J. O'Reilly has been appointed as a member of the Missouri Public Service Commission, succeeding

A. J. O'REILLY

Edward Flad, who recently resigned. Mr. O'Reilly was born in Montgomery County, Mo., fifty-eight years ago. He is a civil, mechanical and electrical engineer, but has spent the greater portion of his life in construction work in St. Louis. He was supervisor of city lighting from 1900 to 1903, engineer of the St. Louis Fire Prevention Bureau during the World's Fair in 1904 and president of the Board of Public Improvements from 1905 to 1909. He holds membership in the American Institute of Electrical Engineers, the American Association for the Advancement of Science, the St. Louis Engineers' Club and the St. Louis Academy of Science.

Alex G. Robb has been appointed assistant to the president of the Niagara Falls Power Company, Niagara Falls, N. Y., and assistant general manager of the Canadian Niagara Falls Power Company, Niagara Falls, Ontario. Mr. Robb has been connected with the Niagara Falls Power Company since 1902 and until recently was superintendent of the Canadian Niagara Falls Power Company and of the Niagara plant of the same company.

Joseph H. Becker, commercial agent of the United Electric Light & Power Company of New York, was operated on last week for appendicitis and gall stones. His many friends in the industry will be pleased to learn that the operation was successful and that Mr. Becker is on the road to recovery.

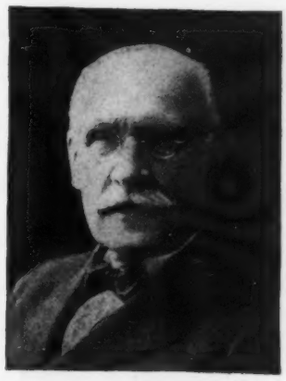
A. E. Wishon, who is general manager of the San Joaquin Light & Power Corporation, has been appointed chairman of the committee on amendments to the constitution of the Pacific Coast Electrical Association by the president, A. R. West. The committee will have the important work of revising the constitution to meet the recent change in name of the organization and will consider as well the various other suggestions toward broadening its field which have been brought up within recent months. Mr. Wishon was president of the association last year and is in close touch with its affairs.

H. O. Garman, the newly elected president of the American Association of Engineers, served as chief engineer and consulting engineer with the Indiana Public Utilities Commission and the Indiana Railroad Commission for more than thirteen years. This position he resigned on Dec. 31, to give his entire time to private interests. Mr. Garman, after graduating from the civil engineering course at Purdue University in 1902, began his engineering career as a track apprentice on the Illinois Central Railroad and after three summer seasons was made assistant engineer. Mr. Garman has been closely associated with the public utilities and has written several standards covering the service of gas plants, electric plants and central-station heating plants. He was also instrumental in placing the engineers and surveyors' license law on the stat-

H. O. GARMAN

ute books of Indiana. Prior to this work he was for ten years a teacher of engineering at Purdue University. He is a member of the American Railway Engineering Society; the American Society of Civil Engineers and the American Institute of Electrical Engineers.

Albert W. Smith, formerly dean of Sibley College, Cornell University, is now connected with the firm of Henry R. Kent & Company, engineers and constructors of New York and Boston, as their consulting engineer. Dean Smith's work will be particularly in consulting on thermodynamics and the mechanical engineering of chemical



A. W. SMITH

plants. He took first and second engineering degrees from Sibley College, and after holding a fellowship in Cornell for one year he served as assistant professor in Sibley College for four years. He was then professor of machine design for one year in the University of Wisconsin and the following year became professor of mechanical engineering in Leland Stanford, Jr., University, in California. He held this professorship for twelve years until he was called to Cornell University as dean of Sibley College, which position he held from 1904 until 1920. During the interval between the resignation of President Schurman and the recent inauguration of President Farrand, a period of a year and a half, Dean Smith was acting president of Cornell University.

R. H. Heising of the engineering laboratory of the Western Electric Company has been awarded the Morris Liebman prize of the Institute of Radio Engineers for the most important contribution to the radio art in the preceding twelve months. Soon after entering the radio research field in 1913 Mr. Heising was connected with the Montauk-Wilmington-Washington wireless experiments and later with the Paris-Arlington tests. During the war he was engaged in the development of circuits for aeroplane and submarine-chaser wireless sets. Recently his efforts have been devoted to the study of radio systems for extending existing Bell telephone service to locations which cannot be reached by wire.

W. C. Starkey, formerly chief engineer of the Ohio Brass Company, Mansfield, Ohio, has been named vice-president and directing engineer of the Stevenson Gear Company, Indianapolis, Ind.

F. H. Leggett, who has just been made general manager of telephone distribution for the Western Electric Company, is a graduate of Dartmouth College. He joined the clerical force of the Western Electric Company in 1898, being advanced in 1902 to be secretary and treasurer of the company's Japanese subsidiary, the Nippon Electric Company of Tokyo. In 1906 he became manager of the Bell Telephone Manufacturing Company of Antwerp, Belgium, and from 1909 to 1912 he was foreign sales manager for the parent company, his headquarters being in New York City. He was Pacific district manager, with headquarters at San Francisco, until 1917, New York district manager until 1919 and Eastern district manager, with headquarters at New York, until 1921. While at San Francisco Mr. Leggett was active in the affairs of the Electrical Development League in that city, serving one term as president. At New York he has been vice-president of the Electrical League and at the present time he is a director.

F. H. LEGGETT

H. M. Thompson will represent the Quigley Furnace Specialties Company, New York, in the Chicago territory. He was formerly identified with the Thomas Moulding Brick Company. He succeeds Bell & Gossett, former agents for the Quigley company. His headquarters will be at 105 West Monroe Street.

John J. Murray, for more than four years in the New York district sales office of the Morgan Engineering Company, 129 Broadway, is now associated with K. I. Clisby & Company, 233 Broadway, New York, representatives of the Ohio Electric Controller & Manufacturing Company, the Magnetic Manufacturing Company and other manufacturers.

Nelson S. Moore, who has been secretary of the Electric Power Equipment Company of Philadelphia for the past five years, has severed his connections with that company and entered sales work in Chicago with Nelson S. Moore & Company.

G. G. Thompson, formerly electrical engineer designing control apparatus and resistors with the Cutler-Hammer Manufacturing Company, has become connected with the Ward Leonard Electric Company, Mount Vernon, N. Y. For the present his attention will be largely directed toward the commercial development of the magnetic theater dimmer and other electrical equipment for the theater. He brings to his work eighteen years' experience in electrical engineering effort, having spent three years with F. F. Van Tuil, consulting engineer, Detroit, three years with the American Electric Fuse Company, Muskegon, Mich., as chief engineer and twelve years in design and control with the Cutler-Hammer Manufacturing Company, Milwaukee.

H. A. Brinkerhoff, who for twenty-five years was with Westinghouse, Church, Kerr & Company and their successors, Dwight P. Robinson & Company, Inc., has resigned and entered consulting engineering practice with R. W. Stovel under the firm name of Stovel & Brinkerhoff. In 1893 Mr. Brinkerhoff entered the service of the C. & C. Electric Company as mechanical draftsman and three years later joined the forces of Westinghouse, Church, Kerr & Company. In the years that followed he held the positions of draftsman, chief draftsman, superintendent, general superintendent, engineer in charge and managing engineer. While with the company he was responsible for many large construction projects, having had charge of the installation of all mechanical and electrical equipment in the Pennsylvania Station, New York, the design and construction of United States Nitrate Plant No. 2 at Muscle Shoals, Ala., and the design and construction of the Winnipeg passenger terminal of the Canadian Pacific Railroad. He has also superintended the design and construction of many industrial plants and power plants. He is a member of the American Society of Mechanical Engineers.

A. B. Cole, formerly assistant to the manager of the department of publicity, Westinghouse Electric & Manufacturing Company, has resigned this position to become president of Andrews, Brown & Cole, Inc., successor to the Morton Company, Cleveland. Mr. Cole was graduated in 1909 from the School of Electrical Engineering, Purdue University, where he made a specialty of steam and electric railway studies. Upon leaving school he entered the engineering apprenticeship course of the Westinghouse company, completing it in 1911. While taking the course he was engaged, in addition to the regular shop testing, on railway project work in the general engineering division and as a railway sales correspondent at East Pittsburgh and afterward in the Cincinnati district office. During the war Mr. Cole co-operated on publicity matters with the American Electric Railway Association war board at Washinggton.

A. B. COLE

Obituary

David J. Braun, a pioneer in the lighting-fixture field, died in Chicago, Dec. 26, at the age of seventy-nine. Mr. Braun came to America from Germany in 1866. In 1874 he went to Chicago and in 1889 he formed the David J. Braun Manufacturing Company. Later this was consolidated with the Beardslee Chandelier Manufacturing Company. The factory of the Braun Company is said to have been the first in Chicago to make lighting fixtures.

Walter J. Richards, chief engineer of the National Brake & Electric Company of Milwaukee, Wis., died on Nov. 22, after a long illness. Mr. Richards was born in Dodgeville, Wis., in 1871, and was graduated from the University of Wisconsin in electrical engineering in 1895. The following year he spent at the university as a fellow in engineering. He then went East and was employed at the Westinghouse plant at East Pittsburgh, Pa. Mr. Richards' life work was virtually all with the Westinghouse industries, with the exception of a short period when he was connected with the Bullock works at Cincinnati. He was chief engineer of the National Brake & Electric Company of Milwaukee for many years. While in the service of this company he took out many patents in connection with air compressors, air-controlling devices and electrical appliances.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Hollow-Ware Outlook Excellent

GOOD business in electric appliances for table service is in sight for 1922. A leading manufacturer of these devices states that from coast to coast the holiday trade exceeded expectations and that the stocks of jobbers and retailers were greatly reduced and in many cases practically depleted by the Christmas demand. While many lines of appliances, especially of the more expensive kind, slumped heavily during the latter part of the year, these lighter appliances moved very well indeed throughout the fall. Toasters, irons, grills and percolators were in particularly good demand, and toward the end of the year some manufacturing by night shift was necessary to fill rush orders from distributers. On this class of appliances very little complaint is now heard as to prices, and a gradual healthy increase in buying for distributers' and retailers' stocks is anticipated. Manufacturing for stock is going forward steadily; raw materials are plentiful, and the stage is set for a thoroughly good year's business in the lighter socket appliances valuable in the dining room and kitchen. Some development work is also under way in cooking apparatus, and a larger line of ranges is soon to be placed on the market by one of the representative appliance makers.

Vacuum Cleaner Sales Good with Prospects Bettering

MANUFACTURERS of electric vacuum cleaners are a unit in looking forward to 1922 with optimism, according to a survey of that field just completed by the ELECTRICAL WORLD. They agree further that instead of merely taking orders every salesman will have to work hard for almost every sale, but by doing this, by training the men more thoroughly and by developing more effective selling methods they expect to continue increasing sales.

General business conditions, of course, will have their effect on retail sales. It is here that a ray of hope is found by some manufacturers, who believe that most sections of the country have passed the worst of the depression and that conditions will improve gradually. One manufacturer believes that general conditions will be about the same in 1922 as in 1921, but expects to bring sales during the coming year up to the 1920 level by sheer sales effort.

The condition of jobbers' stocks is another encouraging factor in the situation. It is noticeable that distributers have been carrying very low stocks during the last six months and have been ordering hand-to-mouth. Thus, jobbers start the new year with little carry-over, the very opposite of the condition in January, 1921. Frequent orders for small lots have been coming in from both distributers and retailers during the last four months, and any sort of improvement in business will react immediately on the manufacturers. The increasing number of wired homes is another consideration. It is estimated that between four and five million wired homes are without vacuum cleaners and that this number is being added to at the rate of one million annually. Each of these homes is a prospect for a vacuum-cleaner sale.

Total sales during 1921 for various companies run from 75 per cent to 85 per cent of 1920 sales. Some companies report greater business than last year, but this is accounted for by the extension of distribution into territories not covered before. These percentages are below current sales, which have shown much improvement in the last four months. One company reports that November, 1921, sales equaled those in December, 1920. The average for the year is pulled down, however, by the dull months of last spring and summer.

Prompt shipments are the rule, the time running from one day to a week. There have been no startling price reductions on cleaners in the past few months, though there have been some drops. Several manufacturers are including a set of attachments free with each cleaner and state that they have increased sales in that way. Practically all manufacturers declare there is little likelihood of a price cut soon and some even state that they do not intend to make any change in price during all of 1922.

Year's Construction Only 8 per Cent Under 1920

THE total amount of construction contracts let in the twenty-seven Northeastern states during 1921, according to figures compiled by the F. W. Dodge Company, was only 8 per cent under the 1920 total. It is doubtful if any other business fared so well in 1921 as the construction industry as a whole has, even though the volume of construction has been so unevenly distributed as to classes of projects and as to locality.

The predominating factor in the year's program was residential building, which amounted to $880,052,000, or 37 per cent of the 1921 total, and represented an increase of 54 per cent over 1920 residential construction. Public works and utilities took second place, amounting to $459,184,000, or 19 per cent of the year's total. Other important items were: Business buildings, $336,920,000, or 14 per cent; educational buildings, $242,562,000, or 10 per cent (this figure representing a very considerable increase in a number of projects and in total value over 1920), and industrial buildings, $173,325,000, or 7 per cent of the year's total.

December building contracts amounted to more than for any previous December with the exception of December, 1919. The total amount of these contracts was $198,518,000, an increase of 3 per cent over the November figure, whereas December usually shows a decline from November. The closing month of 1921 showed an increase of 98 per cent over the corresponding month of 1920.

Beech-Nut Decision Creates Further Confusion in Resale Situation

JUDGING by the comment heard from all sides on the decision of the United States Supreme Court in the Beech-Nut Packing Company resale case, the situation is as badly snarled up as before. In the decision, largely important to other lines of business, the court upheld a ruling of the Federal Trade Commission that the resale price maintenance policy of the Beech-Nut company constituted an unfair method of competition. At the same moment the court declared the company to have the right of refusal to sell to dealers who fail to observe suggested resale prices.

The Beech-Nut case was brought under the federal trade commission act, empowering the commission to issue orders compelling the discontinuance of "unfair methods of competition." The Supreme Court holds that the Beech-Nut system goes far beyond the simple refusal to sell goods to persons who will not sell at stated prices, which in the Colgate case was held to be within the legal right of the producer. The court expressed the opinion that the

order of the Federal Trade Commission was somewhat too broad and suggested that the commission should have required the company to cease and desist from the co-operative methods by which the company and its distributers, customers and agents undertake to prevent others from obtaining the company's products at less than stated prices.

These co-operative methods, which constitute the illegal act, include the reporting of names of dealers who do not observe resale prices, enrolling of dealers upon lists of undesirable purchasers who will not be supplied with products of the company unless they give satisfactory assurance of their purpose to maintain such prices in the future, employment of agents to report dealers who do not observe resale prices, and utilizing numbers and symbols marked upon goods containing the company's products with a view to tracing dealers who may have sold at less than the suggested prices. As described in the daily press, the decision is a complete defeat for the Beech-Nut company and for the practice it followed.

However, counsel for the Beech-Nut company has issued a statement to the effect that the right of the company to decline to sell to dealers who do not observe the fair resale prices suggested has been sustained and that such refusals to sell, *per se*, are without any purpose to create a monopoly and do not violate Section 5 of the federal trade commission act. Thus two dissimilar views are presented with uncertainty still present.

Clarifying legislation is being urged by manufacturers, and a bill, known as the Stephens-Kelly bill, has been presented to Congress. Meanwhile Joseph E. Davis, counsel of the American Fair Trade League and former chairman of the Federal Trade Commission, is preparing an opinion on the scope of the decision.

Tax Law Allows for War Machinery Loss

A CLAUSE in the new tax bill which so far has been little commented upon will save American manufacturers large sums in taxes, estimated at as high as $1,000,000,000. Subsection 8 of Section 234 of the new tax law provides that in the case of buildings, machinery, equipment or other facilities constructed or acquired for the production of articles contributing to the prosecution of the war deduction may be made from the income tax to the extent of the difference between the cost of that equipment and its value today. Those who wish to take advantage of this provision, however, must file their claims not later than March 15, 1922. The provision has been in the tax law since 1918, but could not become effective until the state of war was officially ended.

Dealers and Consumers' Lamp Stocks Almost Liquidated

THE most important factor in the lamp business of the last six months and that of the coming six months, according to a large lamp manufacturer recently interviewed, is the liquidation of stocks in the hands of dealers and particularly of consumers. The situation in the middle of 1920 was that of large stocks in the hands of industrial consumers and some residential consumers. Use of individual lamps became less, of course, with night shifts not working and their life became relatively longer. Thus industrial concerns were not forced to replenish their stock as often as before and in most cases followed the policy of having on hand about 25 per cent of their ordinary replacement supply. With the lessened use of the individual lamps it took some time to reduce their stocks to this extent. Agents are beginning to report better sales to industrials and this would indicate that surpluses have been about used up. While demand for industrial lighting will continue to be considerably less than in 1920, it should improve from now on.

Dealers also have been conservative and have followed the same policy of carrying small though complete stocks. The "Mazda" companies can maintain a close check on agent stocks and it is reported that they are small. Thus the livening of industrial demand will react at once on the manufacturers.

Another indication of good business ahead is the residential construction going on. The large building total of the months since September has been largely residential. In addition, the wiring of old houses has proved a source of good business for the contractor and through him for the lamp manufacturer.

Production during the fall for various companies ranged between 50 and 75 per cent. It is improving now, most of the companies being in a position to increase it the moment they feel demand bettering.

Cut Freight Rate to Pacific Coast on Electrical Goods

REDUCTIONS in freight rates from Eastern territory to Pacific Coast points on electrical appliances and supplies and electrical machinery and several other commodities have been announced by the Southern Pacific Railroad. The old rates on electrical appliances, electrical machinery and supplies, including empty electrical storage and battery boxes, range from $3.25½ per 100 lb. from New York to $2.66½ from Kansas City. The new rates will range from $2.89 to $2.40 from these points. Changes will become effective as soon as the tariffs can be published.

Reports come from the Intermountain territory that the electrical jobbers there are considerably agitated over this reduction of through rates to the Pacific Coast without corresponding reductions in the rates to interior points. It is believed there, according to interviews given a representative of ELECTRICAL WORLD by large jobbers, that if the Interstate Commerce Commission cannot be persuaded to make concessions to the Mountain States, the jobbing territory commanded by Salt Lake City and Denver will be materially reduced and business in general seriously damaged. Strong and concerted effort is being exerted to bring about the realignment of rates, and the governors of five mountain states are preparing data to put before the commission to show the damage likely to be brought about by the differential between the interior and the coast.

Metal Market Situation

BUYING of copper has been light since the first of the year, and dealers who were willing to shade prices have been able to take all the orders which have come into the market. Thus consumers have been able to place their contracts at as much as ⅛ cent under the quotations of the leading interests.

The leading selling agencies have done all in their power to hold up quotations and are refusing to sell under 13⅞ cents to 14 cents per pound, delivered, for the first quarter. Admittedly little business is being done at these prices.

The available surplus has been largely reduced, amounting on Jan. 1 to about 500,000,000 lb. The total supply during the year was 1,655,000,000 lb. Exports during the year amounted to 587,000,000 lb., while domestic withdrawals amounted to 572,000,000 lb.

NEW YORK METAL MARKET PRICES

	Dec. 31, 1921	Jan. 10, 1922
Copper:	£ s. d.	£ s. d.
London, standard spot	66 2 6	66 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.87½	13.75–13.87½
Electrolytic	13.75	13.62½
Casting	13.00	13.00
Wire, base	15.00–15.25	15.00–15.25
Lead, Am. S. & R. price	4.70	4.70
Antimony	4.50	4.45
Nickel, ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	8.50	8.50
Zinc, spot	5.15–5.20	5.12½–5.17½
Tin, straits	33.12½	32.37½
Aluminum, 98 to 99 per cent	19.00	19.10
OLD METALS		
Heavy copper and wire	11.50–11.75	11.25–11.50
Brass, heavy	5.25–5.50	5.25 –5.37½
Brass, light	4.87½–5.00	4.87½–5.00
Lead, heavy	4.00–4.12½	4.00 –4.12½
Zinc, old scrap	2.50–2.75	2.50 –2.75

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS, as might have been expected with so many forces pulling and pushing, has been spotty the last week. Inventories and the reaction from the holidays continued to curtail activity; lower stocks, firmer markets on a few materials and active building joined in helping sales. Boston reports good movement of transformers and weakness in some wiring materials. Jobbers there have low appliance stocks. Chicago notes good movement of high-tension equipment, but trouble over the Landis decision is still affecting building. In St. Louis residence construction is taking a good deal of wiring materials, but other lines are sluggish. Air heaters in Atlanta are dormant, while sales of safety switches are very good. In the Intermountain region cold weather has halted building. Mining, however, has been partly resumed there.

Some price changes are reported, fir cross-arms going up thirteen points and insulators being cut 10 per cent. Rubber-covered wire has become firmer in San Francisco and in the Northwest.

NEW YORK

Although the electrical trade looked generally for a quiet period after the first of the year, business has not been entirely dull. In fact, buying has been more active than had been expected, which is a very encouraging sign. Jobbers report that wiring supplies are moving steadily and there is a tendency on the part of some contractors and dealers to buy in quantities somewhat in excess of their immediate requirements. More inquiries for material in large quantities are appearing. This would indicate that building operations are on the increase.

There has been a good demand for the unit-type lighting fixtures from merchants and commercial houses. While a number of these are being installed in newly constructed buildings, jobbers' salesmen state that at least one-half of their sales have been made to replace old-type fixtures. Another indication of the improvement in general business conditions is the increase in incandescent lamp sales. In addition to the usual sales to replenish stocks, jobbers report that industrial companies which have been partly or wholly shut down are buying lamps in large quantities.

The general attitude of the trade is one of confidence and satisfaction with the gradual improvement in business. There is little inclination to quarrel with present conditions, which are really better than was anticipated two months ago, and the most conservative look for a steady increase.

Conduit.—Stocks are good and there is a fair demand, although sales are mostly in small or moderate size quantities. Prices remain about the same as last reported. Quotations this week were as follows: For ½-in. black pipe in 2,500-ft. lots, $45 to $46; ¾-in., $58 to $59, and 1-in., $83 to $85 per 1,000 ft. Galvanized pipe in the same sizes and quantity was quoted at $50 to $51, $65 to $66 and $92 to $94 per 1,000 ft

Rubber-Covered Wire.—There is little change in conditions in the wire market. A moderate but steady demand prevails. No. 14 rubber-covered is quoted at $6.50 to $6.93 per 1,000 ft. in 5,000-ft. lots. Jobbers' stocks are good.

Heavy-Duty Cord.—The manufacturers of Duracord have announced an increase in the price of this material of from 20 to 25 per cent, depending on the size. This increase has been caused, it is stated, by the higher cost of raw materials and the fact that former prices were out of line with the cost of manufacture.

Flexible Armored Conductor.—Demand for this material continues to be very active, and jobbers have only small reserve stocks on hand, although deliveries from manufacturers are better. No. 14, two-wire, single-strip, is quoted at $45 per 1,000 ft. and double-strip at $47 per 1,000 ft. in lots of that quantity.

Lamp Cord.—Demand is only fair and jobbers' stocks are good to large. Prices remain unchanged. No. 18, cotton, twisted is quoted at $12.90 per 1,000 ft., and the parallel at $15.60 per 1,000 ft. in that quantity.

Heaters.—There has been a fair demand for air heaters of the reflector type. Colder weather and the recent drop in prices seem to have stimulated sales.

Heating Appliances.—Jobbers report that household devices have been fairly active since the first of the year as the dealers are filling up broken lines which were depleted during the holiday rush.

Lamps.—Sales have been exceptionally good since the first of the year. Part of this, of course, is after-inventory buying, but large orders have lately been received from industrial companies whose factories have been idle.

CHICAGO

The merger of several Chicago banks has affected the electrical industry but slightly, the smoothness of the operation seeming to quiet rather than to startle business. The general sentiment appears to be one of approval. Another event of interest was the action taken by the Building Trades Council in rejecting the Landis wage award and deciding to stand by the "outlawed" unions. Although this controversy is slowly being threshed out, it can have little effect on the small seasonal building going on, and very little in the way of results can be expected until spring.

Considering the time of the year, the slump of wiring materials is causing little worry. Most of the jobbers feel that with another week devoted to analyzing 1921 sales figures and estimating 1922 business, they will be ready to start forward again. Electrical materials in general have slowed down like other merchandise at the present time, even with newly lowered prices. The only active commodity at present seems to be high-tension equipment, which is moving well.

Wire.—Buying of No. 14 rubber-covered wire has slumped somewhat during the past week and the stiffened prices have not stimulated trade to any noticeable degree. It still sells for $6.85 to $7 per 1,000 ft. in 5,000-ft. lots. However, jobbers report fairly active sales of weatherproof and bare wire. Weatherproof is quoted at 16¾ cents and the bare-wire base is the same. Stocks of these materials are ample.

Flexible Armored Conductor.—A few jobbers report fairly good activity, but considering the trade as a whole the movement has been sluggish. Jobbers have sufficient stocks on hand to supply demand. No. 14, two-wire, double-strip, in lots of 5,000-ft. sells at $47.50 per 1,000 ft. The same size in the single-strip sells for $45 per 1,000 ft.

Heating Appliances.—Slight price reductions have gone into effect on appliances built by two manufacturers. However, this has produced very little buying on the part of the public during the past week, and dealers state that the people still interested in appliances are looking around for bargains.

High-Tension Equipment.—A sale of a 2,400 kw., 22,000-volt outdoor substation has been made to an automobile plant during the last week by a manufacturer. In addition a sale of a 1,500-kw., 66,000-volt outdoor substation for a copper mine was reported. This company shipped orders during the week for 66,000-volt outdoor substation fittings to China and 22,000-volt substation fittings to Honolulu.

Lamps.—The demand for lamps is still continuing, and jobbers report that the 25-kw. mill type is selling well. The movement of higher voltage lamps is fair.

BOSTON

Business in the electrical field continues with little change, following the opening of the year. Jobbers' stocks were pretty substantially reduced last year, but as yet there has been insufficient quickening in demand to cause active buying, purchases continuing on a hand-to-mouth basis. Prices are holding firm, barring a weakness in attachment plugs said to be due to accumulated factory stocks. Building operations are going forward on a better scale than some time ago, but nothing spectacular is reported in new contracts. Central-station outputs are holding up remarkably well and in not a few cases increased substantially during 1921. Easier money conditions tend to release more distribution system construction as time passes. Industrial heating equipment is in better demand, and a large transformer order from Japan has been received at the Pittsfield works of the General Electric Company, with some increased domestic orders from Southern transmission companies. Manufacturing in New England is doing well on the whole, except in the metal fields.

Motors.—Small-order business dominates the market, with some activity in proposition work. Deliveries are prompt, with some variations among manufacturers as to ability to make immediate shipments from stock. Prices reflect no changes of importance.

Lamps.—Fair sales are being made, with stocks easily meeting requirements. Sales efforts on lamp-using devices have resulted in a healthy growth of business.

Wire.—Routine orders are about all that are going through at present. No. 14 rubber-covered wire sold Monday at $6.75 per 1,000 ft. in 5,000-ft. lots, and weatherproof was moving slowly around 16½ cents base. For some months increased wire installations will be in progress on Massachusetts distribution systems, as the companies gradually overcome the effects of the great November storm. Interior wiring is under way with better volume.

Transformers.—Distribution transformers are not moving very actively, but there is some improvement in demand for large power transformers for hydro-electric developments. A slow revival in the former class of apparatus is anticipated, but better rather than poorer business is looked for henceforth.

Appliances.—Post-Christmas trade in vacuum cleaners showed some signs of life in retail circles. Considerable interest in retail appliance sales was apparent before the old year ended, apart from holiday trade. The washing-machine market continues dull, but the lighter appliances are in fair demand and a good outlook for the year is generally expressed. Jobbers' stocks are so low that replacement buying is not likely to be long deferred.

Industrial Heating Equipment.—A better demand is reported on immersion heaters for tank service. Interest in flat-type heaters is good and central-station power engineers are working on extending the applications of both standard and special equipment for process heating.

Loom.—Ample stocks are still reported and sales are moderate. In 5,000-ft. lots, $\frac{7}{32}$-in. loom sells at $16 per 1,000 ft., and ¼-in. loom at $19.

ATLANTA

All electrical dealers report a very satisfactory business during the holidays, though a general slumping off is in evidence now owing to inventory. That conditions are on the upward trend is evidenced by the fact that bank clearings for the week ending Dec. 24 were approximately $2,000,000 in excess of those for the same period last year. Building permits in Atlanta for the year 1921 amounted to approximately $12,000,000, $2,000,000 below the figure set for 1920. This drop is due, however, to the decline in the cost of building materials and labor and not to a lesser activity in construction, and all indications are that a new high mark will be reached in 1922. Building reports from all cities in this section compare favorably with that of Atlanta.

Non-employment continues to be a problem, although some improvement has been made in some parts of the Southeast, statistics showing the decrease of non-employment in Atlanta to be 4 per cent and in Birmingham 1½ per cent. Work on certain hydro-electric developments that had been stopped during the past few years has started again, and this will tend to absorb some of the unemployed in this section.

Lighting Fixtures.—One of the largest jobbers reports a very fair volume of business in both the residential and commercial lighting fixture lines, though most of the orders are coming from Atlanta. Prospects, however, are bright as regards business in the section as a whole as soon as spring building gets under way. All jobbers report satisfactory stocks on hand.

Portable Lamps.—All dealers report excellent sales in the mahogany-stand and silk-shade types, though the metal lamps are selling only fairly well. Stocks of the former type are depleted. No change in prices is anticipated for some time to come.

Air Heaters.—This line continues dormant on account of the very mild weather in this section and jobbers are anticipating little movement even should cold weather materialize, due to the lateness of the season. Stocks are very heavy, and consequently there will be a large carry-over.

Poles.—No unusual activity is to be noted in the movement of poles, such orders as are received being for maintenance work. While there is a fair demand for all varieties, cypress leads in popularity. A price reduction of 5 per cent on Northern white cedar poles was announced several weeks ago. Producers have excellent stocks and shipments are prompt.

Safety Switches.—As has been the case for some time, the sales in this line are on the increase, and while all sizes are going well, the 30-amp., two-wire switch leads in demand. Stocks are on hand to satisfy normal requirements.

Vacuum Cleaners.—All jobbers report good sales of this specialty during the holidays, and consequently stocks are low. There are no changes in price reported.

ST. LOUIS

A comparison of the building permits for 1921 and 1920 for new work and alterations in the city of St. Louis is of interest in studying the present opportunities for the sale of electrical goods in that field and the changes which must occur in the construction program to improve the sale of electrical materials. The total volume of work authorized in 1921 was slightly less than that in 1920, the respective values being $16,631,305 and $17,694,078, but the volume of strictly new work was slightly greater, the values being $13,805,464 and $13,321,778. Construction of new dwellings and hotels was very much heavier in 1921, amounting to $7,236,695, as compared with $2,281,070 in 1920. The construction of store buildings took a decided slump, amounting to only $787,858, as compared with $1,757,900 in 1920. The biggest decrease occurred in the construction of new manufactories and workshops, which amounted in 1921 to only $668,900 and in 1920 to $3,112,740.

At the present time construction work is divided in about the same proportions as shown above. It is therefore easy to see why it is that rubber-covered wire in small sizes, schedule materials and equipment used by central stations in the distribution of electricity have been experiencing a good demand, while motors and other industrial equipment have had dull movement. Expansion on the part of the industrials is necessary for any material improvement in the sale of electrical goods, and it is very encouraging to note increased activity on their part. Their operations are not much greater than they have been for several months past, but they are apparently anticipating early improvement, for they are making active inquiries regarding the costs of electrical equipment.

Cross-Arms.—A thirteen-point advance in price was made effective Jan. 1 on fir arms. New representative quotations on 3¼-in. x 4¼-in. fir arms, f.o.b. St. Louis, per 100, are: 3-ft., $51.38; 4-ft., $68.31; 6-ft., $102.77; 8-ft., $137.03; 10-ft.,

$152.25. St. Louis stocks are in good shape. Movement is fair, orders being for small lots. Utility stocks are in general low.

Poles.—Prices are slightly higher, representative quotations for Northern white cedar poles, 7-in. tops, f.o.b. St. Louis, in carload lots, being: 30-ft., $8.90; 35-ft., $14.60; 40-ft., $18.65; 45-ft., $21.75. Prompt shipment can be given. Movement is very slow and orders are small.

Insulators.—A price decline of about 10 per cent is announced. Sales have been reasonably good and fair stocks have been built up locally. Central-station stocks are conservatively low. A much-used form of 4,000-volt insulator is selling for $65.28 per 1,000 in lots of 1,000.

Pole Line Hardware.—Prices have remained virtually constant for several months. Conservative stocks are maintained by both jobbers and utilities, and sales have been reasonably satisfactory. Judging by inquiries received, considerable pole-line construction is under consideration.

Packing-House Cord.—The railroads have been good buyers recently, and the total movement is good. No. 14 cord, in lots of 5,000 ft., is selling for $29.36. Stocks are in line with market requirements.

Street-Lighting Cable.—Sales have been very light, and stocks are being maintained on a low basis. No. 8, solid single-conductor, 3,500-volt, is being sold for $140 per 1,000 ft., f.o.b. factory.

SEATTLE—PORTLAND—SPOKANE

A review of conditions at the close of 1921 indicates unmistakable progress on the road to recovery, and the program which is forming for the new year points to a continued forward movement. Bank clearings, postal receipts, building and shipping all show increases over 1920 or compare very favorably with that year's figures. One large oil company of Seattle finds it necessary to increase its storage facilities and will spend $1,000,000 on a new addition. The county in which Seattle is situated is beginning a building program which calls for the expenditure of over $500,000. A Portland lodge has begun construction of a new million-dollar home, and a large number of apartment houses are either started or projected for the near future. In addition many other buildings of considerable size, amounting to millions of dollars, are planned. Thus prospects for building are excellent.

In the electrical trade business has been rather slow during the past week as was expected. However, nothing but optimism prevails as to prospects for 1922. Portland jobbers report that although business is quiet compared with December it is better than it was a year ago. Inventories have been completed and show that overstocks have been practically eliminated and there is a much better balance of stock, although in the active lines quantities are greater than they were a year ago. Small discount changes have been arranged on electrical appliances so as to give the dealer buying smaller quantities the advantage of a larger discount. There is no longer any difficulty in getting stocks in from the East. Dealers of Portland report business good for this time of the year. Store sales are comparatively active and fixture installations are good. Contracting is largely a matter of finishing up work, but the outlook for the coming year is very promising. Dealers report very little overstock at the present time, and for the most part inventories are the order of the day.

Wire.—The demand for rubber-covered wire in Seattle remains fairly good with no pronounced change from previous weeks. Prices on both rubber-covered wire and weatherproof wire have advanced slightly during the past week. No. 14 rubber-covered advanced from $7 to $7.40 and No. 12 from $9.80 to $10 per 1,000 ft. in 5,000-ft. lots. The base price of weatherproof advanced from $17 to $17.50 per 1,000 lb.

Tape.—A steady demand for this material exists according to Seattle reports. No recent price changes have been made. Friction tape is quoted at $28.75 per 100 rolls in small lots. Rubber tape sells at $25.95 per 100 rolls.

SAN FRANCISCO

The new wage schedule for electricians was recently put into effect in San Francisco and the bay cities without opposition. It is $8 per day, the previous schedule having been $9.25 per day. Building prospects for 1922 are declared to be excellent. A feature of the work that is noticeable is the number of office and apartment buildings of from six to ten stories. There is also a considerable amount of theater construction which is now ready for the electrical work. The value of the building permits for December in the principal California cities is as follows: Los Angeles, $9,168,851; San Francisco, $2,007,705; Oakland, $2,149,756; San Diego, $1,775,711. The corresponding figures for December, 1920, are: Los Angeles, $3,803,838; San Francisco, $1,581,945; Oakland, $629,779; San Diego, $1,220,463. It will be noticed that Los Angeles and Oakland rank high. The total value of the building permits in the largest two cities for 1921 was: Los Angeles, $82,447,624; San Francisco, $22,244,672. San Francisco has suffered severely from its sixteen weeks of building strike.

Heating Devices.—New discounts from various manufacturers are now effective, their feature being the decreased number of appliances necessary for the maximum discount. Local stocks are good. Generally speaking, the stocks left over from last year are not so great as those carried over from the previous year, but this was due to careful buying on the part of the dealer because the Christmas just past was not so good as that of the previous year. A feature of 1922 sales is expected to be the waffle iron, on which improvements have been made.

Vacuum Cleaners.—Sales are increasing, remarkably good results being reported from window and entry demonstrations. Daily sales averaging five to ten machines are reported by several dealers in the big cities through stationing their demonstrators at their front entrances. Prices seem to be steady based upon cash prices of $55 to $60.

Rubber-Covered Wire.—No. 14 single-braid, solid, is now selling for approximately $7.50 per 1,000 ft. in 5,000-ft. lots, a slight advance over previous quotations. This commodity is expected to be steadier from now on with a constant upward tendency.

SALT LAKE CITY—DENVER

The past week has been characterized by a sluggish movement of stocks. Inventorying has been the chief concern of most retail houses, and hence there is little disappointment in the small volume of sales. The ready cash available was absorbed by the holiday trade, and this too is reflected in the general slow-up of business now. The Intermountain region has been in the grip of a cold spell which has halted building activities and depressed merchandising generally. The new year has started with the realization that collections are coming about as hard as ever. The old rule maintains—everybody waiting on everybody else. The banks, however, are showing more leniency and not insisting so much on immediate liquidations. Electrical jobbers report fairly heavy stocks in most lines with dealers still buying with utmost caution. The metal situation is much improved. The demand for electrical supplies is showing a gradual revival with the resumption of operations in various states. The construction jobs under way are rather scattered, and most of them are small. Colorado is reported to be in a fairly good condition. Idaho is passing through a period of extreme money stringency, with many bank failures reported. Montana is staging a good "come-back" with the revival of her copper mines and mills. Lack of money in circulation is conceded by all competent to judge to be the one big handicap to business.

Pole-Line Material.—Stocks are good, with demand at a low ebb. A dearth of construction work is responsible for the scattered and small orders. There has been no recent change in price schedule.

Copper Wire.—The market has shown a slight pick-up recently. A few small construction jobs have afforded the outlet. Prices are at a low level.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

General Electric Gets Large Transformer Orders

The International General Electric Company starts the new year with one of the largest foreign power-transformer and lightning-arrester orders in its history. The order was received from Japan, according to word which has been received from the Pittsfield works, where all the company's power transformers are built. The order calls for machines of 350,000 kw. and is said to represent a value of $1,250,000.

The General Electric Company has received an order from a Southern power company for some very large transformers to be used on a 350-mile transmission line. Another good order was received from the Indiana Service Corporation for three large transformers for use at the Spy Run station of the Corporation.

New Pittsburgh Jobbing House Opened

The Peerless Electric & Fixture Company, a subsidiary of the Bluestone Incandescent Light Company, Ltd., Pittsburgh, Pa., has opened an establishment at 409 Smithfield Street, Pittsburgh, to deal at wholesale in electrical supplies, fixtures and radio material. A retail department also is to be conducted by the company.

Allis-Chalmers Bookings Show Slight Decrease

The bookings for December of the Allis-Chalmers Manufacturing Company, according to officials, dropped slightly below those for November, which had been announced as somewhat in excess of $1,500,000. The incoming business based on December orders would be at the rate of $18,000,000 annually.

Confidence in the outlook was expressed by officials of the company, who look for steadily improving conditions.

Black & Decker Announce Freight Allowance

The Black & Decker Manufacturing Company, manufacturer of portable electric tools, has announced that, effective Jan. 3, a freight allowance on shipments of 100 lb. or over to points in the United States and Canada will be made by the company.

This allowance will make it possible for jobbers to sell the company's product in the United States and Canada without adding anything to the price to cover freight.

The move has been advocated by the American Export Association in behalf of its jobber members.

Windmill Farm-Light System in Production

A farm-light plant, consisting of a generator, driven by a wind wheel, and storage cells, has been placed on the market by the Perkins Corporation, Mishiwaka, Ind. Engineers of the Perkins Corporation, which has made windmills for the last sixty years, have been working on the plant for two years in conjunction with those of the Westinghouse Electric & Manufacturing Company and the Hyatt Roller Bearing Company. The plant charges in any wind of greater velocity than 6 miles per hour. A governor on the wheel prevents it from turning any faster than 60 revolutions per minute. According to figures obtained by the Perkins Corporation from the government the greatest length of time a dead calm prevailed in any locality was not long enough to fully discharge the storage batteries of the plant.

House Organ for Contractor-Dealers Started

The Arrow Electric Company, manufacturer of wiring materials, Hartford, Conn., has started to issue *Chained Lightning*, a monthly house organ, for distribution to electrical contractor-dealers. The December issue was the second number of the magazine and contained helpful suggestions for the increase and improvement of the electrical business and a number of news items interesting to contractor-dealers and their customers.

Industrial Electrical Supply Jobber Moves

The Manufacturers' Supplies Service has moved its office from the Pennsylvania Manufacturers' Association headquarters in Allentown and Easton, Pa., to the Wil-Bor Theater Building, Seventeenth Street and Washington Boulevard, Easton. The company handles electrical and mill supplies for coal mines and industrials exclusively, covering the northwestern Pennsylvania territory.

George W. Roddy, who was formerly with the Westinghouse Lamp Company, is manager of sales and H. W. Ecker is in charge of the engineering service department.

Northwestern Electric Making Aluminum Rotor

A new development in motor construction has been announced by the Northwestern Electric Company, 408 South Hoyne Avenue, Chicago, which is building a squirrel-cage induction motor having an aluminum-alloy die-cast rotor. A feature of the motor is that it has twelve symmetrically distributed short projecting blades on both ends of the rotor in order to increase the circulation of air. The company has been working on the characteristics of this motor for more than a year, and the rotor is now perfected to give maximum starting torque for the power consumed. A resistance type electric furnace has been used in melting the aluminum alloy, which is poured into the casting at 1,400 deg. Fahr.

Milwaukee Engineering Company Formed

The Associated Engineers, Inc., has been formed for consulting engineering work by F. W. Ullius, Jr., W. E. Skinner and Ralph M. Kibbe. Mr. Ullius is president of the company, while the active management will be in charge of Mr. Skinner. Mr. Kibbe is secretary and treasurer.

Domestic and Fullerton Announce Merger

The Domestic Electrical Supply Company, Inc., 38 Park Place, New York, has been merged with Fred W. L. Fullerton, Inc., 15 West Twentieth Street, New York, effective Jan. 1. The new house will be known as the Fullerton Electric Company. Offices and stockrooms of the company will be at 230 West Seventeenth Street, New York, with a branch at 232 Market Street, Newark, N. J. Fred W. L. Fullerton is president and general manager of the company, and G. V. Weir is treasurer and assistant general manager.

Motor Outlook Encouraging, Says Boston Manufacturer

"Recent sales of motors in this country and abroad, coupled with inquiries now being received, warrant an optimistic view of this year's operations," declared M. F. Fitch, sales manager motor department, S. A. Woods Machine Company, Boston, last week to a representative of the ELECTRICAL WORLD. Mr. Fitch stated that in response to the demand for this product improved machinery is being installed at the factory to increase its production and that a full line of motors up to and including 25 hp. rating is now being marketed. The Woods company is bringing out a line of individually driven woodworking machinery which is the first in the country to represent a co-ordinated unit built complete with motor by a single manufacturer.

Recent sales include ninety ½-hp. motors for Cluett, Peabody & Company, Troy, N. Y.; eighty motors for the

complete electrification of the L. B. Marble Chair Company, Bedford, Ohio; about sixty motors for the Colored Worsted Company, Providence, R. I., and about twenty-five motors for the new Manchester (N. H.) Arts School. Shipments have been made to Mexico, Japan and England, and foreign inquiries have increased materially of late. Agents on the Pacific Coast and in the Middle West report an improved outlook. Although the company has been manufacturing motors barely eighteen months, several thousand horsepower have already been placed in service.

Crane Award Goes to Cleveland Firm

The Department of Docks, New York City, has awarded a contract to the Wellman - Seaver - Morgan Company, Cleveland, manufacturer of electric cranes, for thirty-four cargo-handling cranes. This installation, the company says, will be the largest of its sort on this side of the Atlantic Ocean. The cranes are to be in operation within one year from the date of the award and will be installed on Piers 12 and 13 at Stapleton, Staten Island. The cranes are all of the semi-portal gantry type. Twenty-six are of 2½-ton to 5-ton capacity and eight are of 1½-ton to 2½-ton capacity. The smaller ones, the company has announced, will be of the Hamburg type, a type new to this country.

Form Westinghouse-Church-Kerr Alumni Association

The Westinghouse - Church - Kerr "Alumni Association" was formed recently at a dinner in New York, attended by 140 former employes of Westinghouse, Church, Kerr & Company, who met to renew the friendships made during their years of service with the company. The association was formed for the purpose of keeping that friendship alive, and the method of obtaining this result agreed upon was to meet every Wednesday for lunch at 180 Fulton Street, New York. All who worked for the company as many as three years are eligible for membership and are invited to get in touch with the secretary, A. H. Tummel, 131 Warwick Street, Brooklyn.

National Stamping Expands Factory Facilities

The National Stamping & Electric Works, 424 South Clinton Street, Chicago, have purchased the property and business of the Lindstrom-Smith Company, 3212-38 West Lake Street, Chicago, and also the land adjoining the latter's plant. When the proposed new extension is finished it will give a frontage of 405 ft. to the plant. The National Stamping & Electric Works have added a new line of appliances, among which are a combination stove and toaster and electric iron. It will also continue to manufacture the "White Cross" electrical household appliances.

Officers of New York Credit Association for 1922

Officers of the New York Electrical Credit Association were elected for the coming year at a meeting of the board of directors held at the Arkwright Club, New York, Dec. 21. F. A. Booth, Westinghouse Electric & Manufacturing Company, was elected president; H. P. Litchfield, Western Electric Company, was elected vice-president, and G. H. Potter, Sprague Electric Works, was elected treasurer. C. A. Kane, Atlantic Insulated Wire & Cable Company, was appointed viewpoint representative. The board of directors, before the meeting, attended a farewell luncheon given in honor of W. R. Conklin, retiring president, and A. F. Thatcher, retiring treasurer.

Sales Representatives Expand

The American Service Company, Pittsburgh, Pa., commercial engineers, has announced that it will expand its correspondence and office facilities to include the sale of household, factory and automobile electrical appliances. C. E. Burroughs is president of the company and I. V. Conneely is general manager.

Used-Machinery Company Opens at Fort Wayne

Articles of incorporation were filed with the Secretary of State recently by the R. & D. Electric Company of Fort Wayne, Ind. The capital stock is $100,000 and the company will engage in the sale and purchase of new and second-hand electrical equipment and machinery. The officers are Rhys Davies, president; W. Charles Dickmeyer, vice-president, and Leonard S. Scott, secretary and treasurer. All the officers are residents of Fort Wayne, and the company is prepared to start operations at once.

Ohio Brass Completes Malleable Iron Foundry

Operations have been started in the recently completed mafleable-iron foundry of the Ohio Brass Company at Mansfield, Ohio., according to announcement of the company. The addition to the plant is on land adjoining the older Mansfield works, but has its own receiving and shipping facilities. There are three buildings in the addition, including a foundry, a powdered-coal plant and a compressor building. The foundry proper has 100,000 sq.ft. of floor space with provision for seventy-two machine molders. A feature of the plant is the use of powdered coal as fuel for the core ovens, melting furnace and annealing furnaces. For the coal-powdering operation a building 35 ft. x 70 ft. x 55 ft. has been erected, and a 4-in. pneumatic tube is used for blowing the coal to the various points where it is used in the foundry. In the first test run three tons of powdered coal were blown to the furnaces in less than five minutes. A vacuum cleaning system is to be used to keep the coal building free from coal dust and dirt.

New Philadelphia Supply Jobber

The Colonial Electric Company, Inc., has opened a wholesale electrical supply house at 932 Arch Street, Philadelphia. The company has taken over the complete stock of J. F. Buchanan & Company, Philadelphia, and is prepared to ship orders from stock. Those interested are Edward J. Coyle, Martin T. Nice and Earl A. Wilson, all formerly with the H. C. Roberts Electric Supply Company, and Roy W. Grosset, formerly with the Frank H. Stewart Electric Company.

The Cote Brothers Manufacturing Corporation, Chicago, manufacturer of "Simplicity" refillable fuses, has removed its general offices to 1425 First National Bank Building, 38 South Dearborn Street, Chicago, where it has larger quarters. Thomas F. Cote is president of the company.

The Coffin-Perry Company, Huntington Bank Building, Columbus, Ohio, has been appointed representative of Edwards & Company, New York City, for the entire States of Ohio, Kentucky and West Virginia and for western Pennsylvania.

The Kimble Electric Motor Company, Chicago, has appointed the Electric Sales Agency, 367 Second Street, Albany, N. Y., as its district sales agent.

The O'Brien Machinery Company, formerly at 119 North Third Street, Philadelphia, now occupies new offices and showrooms at 113 North Third Street. One floor of the five-story building purchased at that location will be devoted to the display of motors, dynamos and generators, while another floor will be given over to the repair and testing of electrical equipment.

The A. I. Bennett Company, Chicago, has been appointed exclusive district sales representative for the Ajax Electric Specialty Company, St. Louis, in Indiana, Illinois, the Michigan upper peninsula, Wisconsin, North and South Dakota and Minnesota.

The Randolph - Perkins Company, 1,210 First National Bank Building, Chicago, has been formed to carry on a general engineering business specializing in hydro-electric development, land, drainage, flood control, etc.

F. H. Scarborough, who represents the Electrical Sales Company, the E. H. Freeman Electric Company and the Trenton Porcelain Company in Philadelphia, has moved his office to 810 Heed Building, 1215 Filbert Street.

The Rome Wire Company, Rome, N. Y., has opened district sales offices in New York City at 50 Church Street. H. S. Hammond, who has represented the company in the Eastern territory for the past twenty years, is in charge of the new office.

Foreign Trade Notes

PROPOSED WATER-POWER DEVELOPMENT AT TIVOLI, ITALY.—A project for utilizing the waterfalls at Tivoli, Italy, for generating electricity, the *Electrician* states, has been approved by the Municipal Council of Rome.

ELECTRIC RAILWAY PROPOSED BETWEEN PEKING AND TIENTSIN.—Application has been filed with the Chinese Ministry of Agriculture and Commerce by a Tientsin merchant, according to the *Electrician*, for permission to form a company for the construction of tramways between Peking and Tientsin. A hydro-electric plant will be installed at Hwaika, where water power from the Yungting River will be utilized. The proposed plant, it is expected, will supply electricity to factories and industrial plants along the route. The Fu Sin Electric Company of Shen Tseh, Kiangsu, and the Changsu Electric Company of Changsu, Kiangsu, have been registered by the Ministry of Communications.

INCREASED SUPPLY OF ELECTRICITY FOR CHRISTIANIA, NORWAY.—To meet the rapidly increasing demand for electricity for domestic purposes, according to a report from Consul-General Alban G. Snyder, Christiania, Norway, additional energy was expected to be transmitted to the municipal electric light works from Raanaasfossen by the first of the new year, later from Rjukan, and in 1924 from Solbergfoss. The problem of receiving and distributing the extra power is progressing rapidly. At the present time there remains only one-fifth of the city to be exempted from all power restrictions, and this, it is expected, will be released in the spring.

RESOURCES OF HUMBER VALLEY, NEWFOUNDLAND, TO BE DEVELOPED.—Contract has been awarded by the Reid Newfoundland Company, St. Johns, Newfoundland, for the development of the resources of Humber Valley in that island, including the construction of paper mills with a capacity of 1,000 tons daily, aluminum works and other industries, and water-power development.

WATER POWER IN CATANIA, ITALY, TO BE DEVELOPED.—A loan of 200,000,000 lire ($10,000,000) has been authorized by the Italian government to a society which has been organized to utilize the water power available in Catania, in southern Italy. It is planned to develop about 300,000 hp. by utilizing natural basins along the rivers. About 500 communities are expected to derive benefit from this hydro-electric project, which eventually will require about $25,000,000 capital.

HYDRO-ELECTRIC POWER FOR SANTIAGO AND VALPARAISO, CHILE.—The project of the Cia Nacional de Fuerza Electrica providing for the transmission of electricity generated at a hydro-electric plant on the Maipo and Colorado Rivers in the Province of Santiago, according to reports to the Department of Commerce, is to be carried through promptly. The plant is located on what is known as the Maitenes concession, and it will have an initial capacity of 33,000 hp., with provision for the installation of an additional generating unit. Power will be generated at Maitenes at 6,600 volts, 50 cycles, three-phase, which will be stepped up to 110,000 volts for transmission. The transmission line to Santiago will consist at first of two circuits of aluminum conductors carried on double-circuit steel towers. From Santiago the line will be carried on one set of double circuit towers over the Dormida Pass to Valparaiso. S. Pearson & Son, who hold the controlling interest in the Chilean Electric Tramway & Light Company, Ltd., has subscribed £850,000 to augment the £650,000 of capital of the Cia Nacional de Fuerza Electrica. This contribution to its capital will enable the power company to proceed with the construction of an additional plant.

IMPROVEMENTS TO ELECTRIC SYSTEM IN LIMA, PERU.—Extensive improvements are contemplated by the Empresas Electricas of Lima, Peru, according to cable advices to the Department of Commerce. A loan of 1,000,000 Peruvian pounds offered to the Empresas Electricas by the government for the above work has been approved by the stockholders of the company.

PROPOSED POWER SCHEME FOR ZEEHAN, TASMANIA.—Data are being collected by C. B. Davis, an engineer on the staff of the government Hydro-Electric Department, the *Industrial Australian and Mining Standard* states, preparatory to preparing plans for a scheme to supply electricity to Zeehan, the source of power to be the Lake Margaret power station of the Lyell company.

MUNICIPAL ELECTRIC SYSTEM PROPOSED FOR LISMORE, AUSTRALIA.—The Municipal Council of Lismore, New South Wales, Australia, has approved a report for a municipally controlled electric lighting system for Lismore, according to the *Industrial Australian and Mining Standard*. The proposed plant involves an expenditure of £32,152. The equipment will include two 150-kw. steam-driven alternators. The present plans provide for 110 street lamps.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Agencies are desired by a merchant in Brazil (No. 503) for the sale of electrical supplies, etc.

The purchase is desired by a business man in Guatemala (No. 506) of a sulphuric-ether plant for the purpose of manufacturing industrial alcohol from cane-sugar molasses. Prices required on plants using both electricity and wood.

The complete outfit for a new theater is required by an amusement company in Canada (No. 527), including electrical fittings.

Tolnai Vilaglapja, Budapest, Hungary, VII, Dohany-Utca 12, would like to receive catalogs covering lighting fixtures and all accessories, electric dynamos and motors.

New Apparatus and Publications

STREET-LIGHTING UNIT.—A street-lighting unit for ornamental posts designed for use with "Mazda C" lamps, known as the "Reflexto-Lux lantern," has recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

MARINE EQUIPMENT. — Circular reprint 106, recently issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., shows the diversity of marine products manufactured by the company.

ARC WELDING.—Leaflet 1825, published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes arc welding for repair and reclamation, general applications of arc welding and arc welding for manufacturing processes.

SWITCHES AND PANEL BOARDS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing catalog 12-A, dated 1921-1922, describing its various types of safety switches and panelboards.

FOOD MIXER.—The Reynolds Electric Company, 2,650 West Congress Street, Chicago, has recently developed the "Reco" food mixer, designed for hotel kitchens, restaurants, hospitals, etc. A food chopper can be furnished when desired.

GLUE POTS.—A new folder issued by the Automatic Electric Heater Company, Warren, Pa., describes the temperature-control features of Sepco automatic electric glue pots.

HAIR CUTTERS.—The P. A. Geier Company, Cleveland, is distributing a folder on the place of the Royal electric hair cutter in the modern barber shop.

AIR COMPRESSORS AND PUMPS.—The Pennsylvania Pump & Compressor Company, Easton, Pa., is distributing bulletin No. 102, covering the "Pennsylvania" single-stage, straight-line air compressors and vacuum pumps.

MOTOR-GENERATOR SETS. — Bulletin No. 30 issued by the Ridgway Dynamo & Engine Company, Ridgway, Pa., describes and illustrates its various types of motor-generator sets.

TURBINES — Steam turbine-generator units are described and illustrated in circular 1094-B, recently issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

OVEN. — The Despatch Manufacturing Company, 116-122 First Avenue North, Minneapolis, is distributing a six-page leaflet describing the "Despatch-Universal" electric oven No. 280, designed to meet the requirements of the electric service station, garage and manufacturer.

SWITCH BOXES.—The Ward Electric Company, Otis Building, Philadelphia, has recently placed on the market a line of pressed-steel flush switch and receptacle switch boxes, arranged for loom, conduit and flexible armored conductor.

GRINDER.—An improved type of pedestal grinder and bench grinder has recently been placed on the market by the Standard Electric Tool Company, Cincinnati, Ohio.

SWITCHES.—Circular No. 52, issued by the Trumble Electric Manufacturing Company, Plainville, Conn., describes its new 600-volt "Snuff-Arc" type A safety switches.

FANS.—"A Breeze That Blows Profits Your Direction" is the title of a booklet distributed by the Robbins & Myers Company, Springfield, Ohio, covering its different types of electric fans, including oscillating and non-oscillating fans, and also fans for farms and country homes.

New Incorporations

THE FAIRFAX & LOUDOUN LIGHT & POWER COMPANY, Fairfax, Va., has been incorporated with a capital stock of $100,000. Thomas R. Keith, Fairfax, is president, and Joseph Berry, Vienna, is secretary.

THE ROCKHOUSE LIGHT & POWER COMPANY, Burch, W. Va., has been incorporated with a capital stock of $5,000 by E. McD. Harmon, B. J. Calloway, both of Burch, and James A. Goble of Matewan.

THE WORTHINGTON LIGHT & POWER COMPANY, Butler, Ohio, has been incorporated with a capital stock of $60,000 by R. C. Dalton, Jr., G. H. Scrack, L. C. Gratner, Albert Keckler and F. S. Culp.

THE OCHILTREE ELECTRIC COMPANY, Pittsburgh, Pa., has been incorporated with a capital stock of $115,000 to manufacture and deal in electrical appliances. The incorporators are David H. Thomas, 812 North Negley Avenue, Pittsburgh; H. S. McDouglass, 1100 North Park Street, McKeesport, and Herbert D. Lent, Jr., 5,003 Fifth Avenue, Pittsburgh.

THE RAMONA & OCHELATA LIGHT & POWER COMPANY, Tulsa, Okla., has been incorporated with a capital stock of $30,000 by P. J. Minck, E. M. Bond and Erwin H. Doerner, Tulsa.

THE MAINE ELECTRIC COMPANY, Inc., Brooklyn, N. Y., has been incorporated with a capital stock of $20,000 by George and C. Lauringer, Jamaica, and P. Kreus, 818 Knickerbocker Avenue, Brooklyn.

THE EMPIRE SWITCHBOARD COMPANY, Brooklyn, N. Y., has been incorporated with a capital stock of $80,000 by N. P. Findley and C. E. Schoninger. R. J. Kent, 75 Fulton Street, is attorney.

THE TIPPINGS & SPRENGLE RADIO MANUFACTURING COMPANY, Pittsburgh, Pa., has been incorporated by L. H. Tippins, William A. Bonkin and W. L. Sprengle, Pittsburgh. The company is capitalized at $75,000 and proposes to manufacture electrical devices.

THE PILOT ELECTRIC MANUFACTURING COMPANY, Brooklyn, N. Y., has been incorporated with a capital of $5,000 by M. Berman, M. Berwitz and E. Halpern. H. Schapiro, 261 Broadway, is attorney.

THE ATLAS ELECTRIC SIGN CORPORATION, New York, N. Y., has been incorporated with a capital of $15,000 by D. Weiss, F. C. Pflueger and G. Searing. M. Sulzberger, 565 Fifth Avenue, is attorney.

THE KAUFFMANN-LLOYD MANUFACTURING CORPORATION has filed articles of incorporation under the laws of the State of Delaware. The incorporators are T. L. Croteau, M. A. Bruce and C. H. Blaske, Wilmington. The company is capitalized at $1,000,000 and proposes to manufacture electrical and other appliances.

THE S. C. TARRANT COMPANY, Wilmington, Del., has been incorporated with a capital stock of $50,000 to manufacture electric lighting fixtures, etc. The Colonial Charter Company, Ford Building, represents the company.

THE CROPSEY (ILL.) LIGHT & WATER COMPANY has been incorporated with a capital stock of $5,000 by S. H. C. and Kenneth Slater. K. Y. Slater, Cropsey, is manager.

Record of Electrical Patents

Notes on United States Patents

(Issued Sept. 27, 1921)

1,392,165. FLASHLIGHT; Robert L. Hunter, Norfolk, Va. App. filed Feb. 18, 1921. Adjustable focus.

(Issued Dec. 13, 1921.)

1,400,126. CONTACT DEVICE; James A. Wotton, Montclair, N. J. App. filed Dec. 16, 1920. High-speed relay.

1,400,149. ELECTROTHERAPEUTIC APPARATUS; Thomas W. Gleeson, Boston, Mass. App. filed Dec. 17, 1920. For electrically treating and massaging.

1,400,156. ELECTRICALLY HEATED SOLDERING IRON; James T. Griffin, Oak Park, Ill. App. filed July 17, 1919.

1,400,181. SEMI-AUTOMATIC TELEPHONE EXCHANGE SYSTEM; Lipa Polinkowsky, London, England. App. filed Oct. 23, 1918.

1,400,189. MEANS FOR CONTROLLING REPEATER CIRCUITS; John F. Toomey, New York, N. Y. App. filed Oct. 16, 1917. Four-wire repeater circuits.

1,400,199. INDICATING MECHANISM; Frank W. Wood, Montclair, N. J. App. filed Jan. 4, 1919. For automatically indicating direction and extent of swinging of structures.

1,400,229. ELECTRIC CIRCUIT CONTROL; Howard J. Murray, Brooklyn, N. Y. App. filed July 15, 1919. Circuit controlled by pendulum oscillated by variation in speed of vehicle.

1,400,235. METHOD OF AND MEANS FOR PRODUCING ALTERNATING CURRENTS; John H. Payne, Jr., Schenectady, N. Y. App. filed Sept. 14, 1916. Electron-discharge device.

1,400,268. BATTERY-CHARGING SYSTEM; William L. Cully, New York, N. Y. App. filed Jan. 9, 1920. Employing motor-generator set.

1,400,270. RECORDING DEVICE FOR SIGNAL SYSTEM; Peter P. Dean, New York, N. Y. App. filed June 30, 1916. For operation of steamships.

1,400,283. SUBMARINE TELEPHONIC TRANSMITTER; Henry R. Gilson, New Rochelle, N. Y. App. filed Sept. 25, 1918. Very great responsiveness.

1,400,305. ELECTRIC HAIR CURLER; Marie Miller, Ottawa, Canada. App. filed March 22, 1920.

1,400,333. FLUOROSCOPIC X-RAY SYSTEM; Harry F. Waite, New York N. Y. App. filed Nov. 20, 1920.

1,400,334. GUARD FOR TELEPHONE TRANSMITTERS AND THE LIKE; Gladys H. Weinrich, Chicago, Ill. App. filed March 10, 1921. For protection from infection.

1,400,336. WINDING FOR DYNAMO-ELECTRIC MACHINES; Robert B. Williamson, Milwaukee, Wis. App. filed Dec. 1, 1916. Alternating-current machines of comparatively large size.

1,400,346. MERCURY-VAPOR LAMP; Marie Joseph Cornu, Paris, France. App. filed Feb. 28, 1918. Damper of mercury oscillations, and arc-striking device.

1,400,357. CABLE SECURING DEVICE PARTICULARLY APPLICABLE TO THE FIXATION OF ELECTRIC CABLES ON CARBON BRUSHES; E. Gindre, Levallois-Perret, France. App. filed May 14, 1921.

1,400,410. ELECTRIC RESISTANCE; Pierre Bossu, Paris, France. App. filed Aug. 25, 1917. For switching or regulating.

1,400,418. ELECTRODE HOLDER; Herman A. Casey, Duluth, Minn. App. filed June 25, 1920. Manufacture of calcium carbide from coal and limestone.

1,400,437. SADIRON; Elmer Hysell, College Hill, Pa. App. filed March 24, 1921.

1,400,476. TROLLEY-HARP ATTACHMENT; J. C. Cooper, Sr., Altoona, Pa. App. filed Sept. 1, 1921. Loosely mounted upon trolley-wheel axle.

1,400,493. TELEGRAPH SYSTEM; Paul M. Rainey, Glen Ridge, N. J. App. filed Feb. 8, 1918. For manual or automatic transmission.

1,400,501. REGULATING SYSTEM FOR DYNAMO-ELECTRIC MACHINES; Oliver F. Conklin, Detroit, Mich. App. filed April 28, 1917. Combined voltage regulator, reverse-current cut-out and modifying thermostat.

1,400,502. SYSTEM OF ELECTRICAL DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed Aug. 13, 1919. Car-lighting systems.

(Issued Dec. 20, 1921)

15,251 (reissue). ELECTRIC PLUG RECEPTACLE; William Ile, Lynbrook N. Y. App. filed March 9, 1920. Plurality of socket members.

15,252 (reissue). SLIDING TROLLEY; Otto Moore Frankfort, Ind. App. filed Oct. 1, 1921. Combined wheel and sliding trolley.

1,400,517. RECORDING APPARATUS FOR RADIO-TELEGRAPHIC SIGNALS; Andre E. Blondel, Paris, France. App. filed April 26, 1919.

1,400,526. ELECTRIC WATER HEATER; Herbert W. Christian, Detroit, Mich. App. filed Sept. 7, 1920. Water flows in form of film.

1,400,583. TELEPHONE SYSTEM; John F. Toomey, N. Y. App. filed April 18, 1918. Switchboards with long-distance transmission line.

1,400,590. SELECTIVE TELEPHONE SYSTEM; Alfred H. Dyson, Chicago, Ill. App. filed Nov. 29, 1907. Combined manual and automatic.

1,400,591. ELECTRICAL WAVE TRANSMISSION; Cornelius D. Ehret, Philadelphia, Pa. App. filed March 12, 1919. Carrier-current telephony.

1,400,603. ELECTRICAL RELAY; Clinton O. Harrington, Edgewood Borough, Pa. App. filed Jan. 31, 1920. Method for opening and closing relay shunt.

1,400,607. GUARD FOR X-RAY TUBES; George C. Johnston, Pittsburgh, Pa. App. filed Aug. 21, 1919. Guards for terminals.

1,400,646. ELECTRIC STOPPER FOR FLUID CONTAINERS; Ernest C. Webster, Chicago, Ill. App. filed April 12, 1920. Heating element in plug of containers.

1,400,649. WEATHER PROTECTOR FOR COUPLINGS; Harry F. Woernley, Pittsburgh, Pa. App. filed Dec. 6, 1918. Protects contacts of train couplings.

1,400,681. TROLLEY WHEEL; Herman M. Kaul, Cedarburg, Wis. App. filed Jan. 12, 1921. Spiral groove return.

1,400,686. TERMINAL CONNECTION FOR ELECTRICAL HEATING UNITS; Frank Kuhn, Jay A. Hand and Jules G. Spiess, Detroit, Mich. App. filed Nov. 14, 1918. Construction to prevent overheating.

1,400,729. ELECTRIC REGULATION; John L. Creveling, White Plains, N. Y. App. filed Jan. 25, 1916. Automatic regulation of generators.

1,400,732. SIGNALING SYSTEM; Charles S. Demarest, Brooklyn, N. Y. App. filed May 12, 1919. Telephone trunk circuits.

1,400,775. ELECTRIC LANTERN; Jerome W. Smith, Walla Walla, Wash. App. filed Feb. 17, 1920. Portable electric light.

1,400,779. BRUSH ARRANGEMENT FOR DISK-SHAPED COMMUTATORS; Hermann Sundhaussen, Essen, Germany. App. filed Jan. 15, 1921.

1,400,784. SOLDERING IRON; Charles B. Archer, Chapman, Ala. App. filed Oct. 19, 1920. Combined solder iron, melting pot and file.

1,400,803. ELECTRICAL APPARATUS; David Conlan, Jr., Brooklyn, N. Y. App. filed Dec. 24, 1920. Current extension apparatus for marine and water-tight uses.

1,400,811. DIMMER; Joseph Galamb and Earl P. Oswald, Detroit Mich. App. filed May 20, 1918. For automobile lights.

1,400,819. PORTABLE ELECTRIC LAMP; Joseph W. Higgins, Bordentown, N. J. App. filed Jan. 26, 1920. Flashlight combined with small generator.

1,400,824. ELECTRICAL FITTING; Homer G. Knoderer, Englewood, N. J. App. filed Oct. 18, 1920. For mounting electric fixtures.

1,400,832. ELECTRIC CLOCK; Louis E. Shaw, East Orange, N. J. App. filed Dec. 8, 1919. Electromagnetic mechanism for movement.

1,400,846. HEATING APPARATUS FOR METAL-WORKING MACHINES; Charles E. F. Ahlm and Thomas F. Ferry, Cleveland, Ohio. App. filed May 7, 1920. Electrically heats material being worked on.

1,400,847. SYSTEM OF RADIO COMMUNICATION; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Dec. 31, 1918. Having high-frequency alternator.

1,400,856. SYSTEM OF ELECTRICAL DISTRIBUTION; William L. Bliss, Niagara Falls, N. Y. App. filed April 3, 1916. For transferring load to battery on failure of other supply.

1,400,859. MULTIPLE REFLECTOR; Ermund N. Brown and Milton H. Shoenberg, San Francisco, Cal. App. filed Nov. 4, 1920. For radiant heater.

1,400,950. PANEL; Guss H. Gneiss and Charles J. Peterson, Chicago, Ill. App. filed Feb. 27, 1919. Fuse panelboards for small-service distribution.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MIDDLEBURY, VT.—The Community Light & Power Company plans to build a switching station in the southern part of the town of Middlebury to step down electricity purchased from the Vermont Power Company from 44,000 volts to 2,300 volts for distribution by the Community Light Company. Extensions to East Middlebury and vicinity and Salisbury are under consideration. E. L. Kelley is clerk.

LEOMINSTER, MASS.—Steps have been taken by the Chamber of Commerce to secure improvements to the lighting system at Monument Square. The fire department plans to place the fire-alarm wires underground.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company has filed notice of an increase of $2,720,000 in its capital stock, the proceeds of which are to be used for improvements and extensions to its system.

Middle Atlantic States

BUFFALO, N. Y.—A petition has been submitted to the City Council requesting improvements to the street-lighting system on Fillmore Avenue from North Parade Street to Main Street.

SOUTHOLD, L. I., N. Y.—The Long Island Lighting Company, 50 Church Street, New York City, is considering the construction of a new electric power plant at Southold, Long Island. E. L. Phillips is president.

UTICA, N. Y.—The construction of a one-story power house at the St. Joseph's Infant Home, Green Street, is under consideration in connection with the new mechanical laundry building, to cost about $45,000.

BUTLER, N. J.—An issue of $76,700 in bonds has been disposed of by the Borough Council for the construction of an addition to the municipal electric power plant.

CHESTER, PA.—The board of directors of St. James' Mercy Hospital contemplates the construction of a two-story power plant, 53 ft. x 60 ft., in connection with a new 4-story hospital. F. F. Durang, 1220 Locust Street, Philadelphia, is architect.

DANVILLE, PA.—A portion of the Danville power house of the Pennsylvania Power & Light Company, Allentown, was recently destroyed by fire. The loss, including equipment, is placed at about $100,000. The company plans to rebuild.

MAHANOY CITY, PA.—The installation of an electric light plant and other improvements at the Schuylkill County Insane Hospital is under consideration by the County Commissioners.

ORRTANNA, PA.—S. Z. Musselman of McKnightstown is reported to have purchased property near Orrtanna for the purpose of erecting an electric light and power plant.

PITTSBURGH, PA.—The Duquesne Light Company has awarded contract to Dwight P. Robinson, engineer, 125 East Forty-sixth Street, New York City, for extensions to its plant. The project includes the installation of a second unit of 60,000-kw. capacity at the Colfax power station together with three additional substations along the lines of the company in the Pittsburgh district. The Colfax station will have an ultimate capacity of six 60,000-kw. units.

SCRANTON, PA.—In a report submitted to A. M. Wilson, city manager, by Joseph L. Caldwell, city electrician, recommendation is made that all arc lamps be replaced with 250-cp. or 400-cp. lamps; that five-lamp poles on North Tejon Street, Colorado Avenue and Pikes Peak Avenue be converted into two-lamp standards; that on the other street where five-lamp poles are used one-lamp standards be substituted; that the police red-light system be extended and also that a police daylight signal system be installed.

SHAMOKIN, PA.—The Taubel, Scott & Katzmiller Company has had plans prepared for the construction of a one-story power plant at its local textile mills.

BALTIMORE, MD.—The Electrical Commission has ordered that all overhead wires except those needed for the operation of street cars and for other exceptional uses in the northeastern section of the city be placed in the city's electrical subways in that territory and poles taken down.

BALTIMORE, MD. — Plans are under way for the installation of new electric lighting systems in fifteen schools in Baltimore. Lester L. Kinsbury is chief electrical inspector.

CLIFTON FORGE, VA. — The Blue Ridge Power Company, it is reported, is considering the construction of two additional power plants on the Green River in Polk County, N. C., to have a capacity of 45,000 hp. and 10,000 hp.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, United States Army, Washington, D. C., until Jan. 23 for furnishing thirty testing sets. (Circular PR 8882-A-14 CP.)

North Central States

BROOKLYN, MICH. — Henry Ford has purchased power rights and a mill on the Flat River at Brooklyn from Blanchard Brothers and contemplates power developments. He has also purchased property in the village.

DETROIT, MICH.—Bids will be received by Edward N. Hines, chairman of the Board of Wayne County Road Commissioners, 1103 Real Estate Exchange Building, Detroit, until Jan. 31 for the installation of electrical equipment for the operation of a double-leaf bascule bridge crossing the River Rouge, as well as for lighting, signals, telephones, etc.

CINCINNATI, OHIO.—Bids will be received at the office of the clerk of the Board of Education, eighth floor, Denton Building, Seventh and Race Streets, until Jan. 23 for furnishing all material and labor necessary to complete the electric lighting work at the Linwood Public School Building.

HUDSON, OHIO.—The City Council of Cleveland has passed as an emergency measure an ordinance authorizing the expenditure of a sum not to exceed $16,000 for the erection of an electric transmission line, installation of transformers, construction of 11,000 ft. of water pipe, installation of electric pumps for fire apparatus and laundry, and other equipment necessary to secure electric service and water supply for the boys' farm division in Hudson.

FAIRBURY, ILL.—The establishment of a municipal electric light plant in Fairbury is under consideration by the Council.

NAPERVILLE, ILL. — Plans are under consideration for an addition to the electric light plant in Naperville, to cost about $50,000. For further information address J. A. Reuss, Reuss State Bank Building.

KENOSHA, WIS.—The sum of $25,000 has been appropriated for the installation of an ornamental lighting system on various streets in Kenosha. M. J. Donahue is engineer.

MILWAUKEE, WIS. — Bids will be received by the Sewerage Commission, City Hall, until Jan. 27, for furnishing and erecting pumps, motors and equipment for an automatic electric return sludge pumping plant on Jones Island, Milwaukee, including three 20-in. centrifugal pumps of vertical-shaft type, three 50-hp. variable-speed, wound-rotor motors; switchboard, electrical control apparatus, wiring and appurtenances; cast-iron pipings and specials, gate and check valves and appurtenances. John H. Fowles is secretary.

MILWAUKEE, WIS.—The City Board of Estimates has voted to place $500,000 in the 1922 budget for a municipal electric light plant. The proposed plant will supply electricity for the new street-lighting system and for other municipal purposes.

MAGNOLIA, MINN.—The village authorities are considering the installation of an electric lighting system in Magnolia, to cost about $11,000.

EMINENCE, MO.—A company has been organized by local business men for the purpose of building an electric light plant for municipal and industrial purposes. Capital stock to the amount of $10,000 has been subscribed.

MOUNT MORIAH, MO. — The Missouri Electric, Gas & Water Company, First Wisconsin National Bank Building, Milwaukee, Wis., has been granted a franchise for the distribution of electricity for light and power in Mount Moriah, and extension from its lines at Cainesville, Mo., will be made immediately. The company, it is reported, also intends to extend its lines north into southern Iowa. W. N. Albertson, Milwaukee, is president.

Southern States

LANSING, N. C.—The City Council is considering the establishment of an electric lighting plant in Lansing. E. V. Ballou is in charge.

ATLANTA, GA. — R. C. Turner in his annual report recommends the installation of a water turbine and electric generator to utilize the water at the Hemphill waterworks station to generate electricity to light the entire waterworks plant.

LOUISVILLE, GA.—Plans are under consideration by the City Council for reconstruction of the municipal electric light plant recently destroyed by fire.

DE LAND, FLA.—Plans have been prepared by the De Land Light, Power & Ice Company for extensions and improvements to its power plant, to cost about $75,000.

ST. AUGUSTINE, FLA.—The Council is considering issuing $30,000 in bonds for the establishment of a municipal electric light and power plant in St. Augustine.

PARIS, TENN. — Improvements to the municipal electric light and sewerage systems are under consideration by the Council. W. J. Holman is engineer.

ARKADELPHIA, ARK. — The Caddo River Power & Irrigation Company, Little Rock, recently organized with a capital stock of $1,000,000, contemplates the construction of a hydro-electric power plant near Arkadelphia, on the Caddo River, to cost about $800,000. H. L. Remmel is president and H. C. Couch is secretary.

MOUNTAIN HOME, ARK. — Improvements to the local light plant, roller mill and ginnery are under consideration by N. L. Taylor, Kansas City, Mo. It is also proposed to erect an electric transmission line to Cotter, Ark.

BASTROP, LA.—Plans are under consideration for the installation of a new electric generating unit in the municipal electric light plant.

HAYNESVILLE, LA.—The Haynesville Light & Power Company contemplates the installation of new machinery.

LAWTON, OKLA.—Bonds to the amount of $600,000 have been voted for the construction of a municipal electric power plant and distribution system in Lawton.

LOCUST GROVE, OKLA.—The construction of an electric light system in Locust Grove, to cost about $20,000, is under consideration by the Council. V. V. Long & Company, 1,300 Colcord Building, Oklahoma City, are consulting engineers.

WOODWARD, OKLA.—Plans are being prepared by the City Council for the construction of a new municipal electric light and power plant, to cost about $100,000.

MERCEDES, TEX. — The City Council has ordered an election to be held in the latter part of January for the purpose of submitting to the voters a proposal to issue $100,000 in bonds for extensions and improvements to the street-lighting system and for paving.

SAN ANTONIO, TEX.—The San Antonio Public Service Company, subsidiary of the American Light & Traction Company of New York, contemplates an expenditure of approximately $1,500,000 for extensions and additions to its property in San Antonio during 1922. While detailed estimates have not been decided upon, it is stated that $500,000 will be used for a new steam-turbine unit for the power plant, and additional boiler capacity and electrical equipment; for electric distribution lines, poles, underground systems, transformers, meters, etc., the sum of $300,000 will be expended.

Pacific and Mountain States

CANBY, ORE.—The construction of a municipal electric light and power system is contemplated by the Council. The city has been authorized to appropriate 300 sec.-ft. from Mill Creek for the development of power.

FRESNO, CAL.—The San Joaquin Light & Power Corporation is reported to be considering the extension of its electrical service through Mussel Slough district.

FRESNO, CAL.—Plans are being prepared by the Sugar Pine Lumber Company, First National Bank Building, San Francisco, for the construction of a new lumber mill, including a power plant, on the San Joaquin River, near Fresno, to cost about $2,000,000. Elmer H. Cox is president.

HOLLYWOOD, CAL.—The Pacific Electric Railway Company, Los Angeles, has been authorized by the State Railroad Commission to make improvements to its Hollywood system at a cost of $2,600,000.

OAKLAND, CAL. — A company to be known as the Central Sierra Power Company is being organized in New York for the purpose of developing an irrigation project to supply eastern Sacramento County and to utilize power that can be developed between the North Fork of the American River and the Rubicon River to supply municipalities and manufacturing concerns of the coast district. The work includes the construction of a large mill, canals, main reservoirs at French Meadows to have a capacity of 60,000 acre-ft. and a continuous flow of about 490 sec.-ft. to power houses. Power house No. 1, to be located at Emigrant Gap, North Fork of the American River, will have a capacity of 89,500 hp.; power house No. 2, opposite Towle, North Fork of the American River, 44,800 hp.; power house No. 3, near Colfax, 31,300 hp.; power house No. 4, near Auburn, 26,800 hp. The cost of the projects is estimated at $20,000,000. H. E. Barleau, Auburn, is engineer. F. P. Tuttle, Jr., 428 Thirteenth Street, Oakland, is attorney.

SAN FERNANDO, CAL.—At an election to be held Feb. 26 a proposal to issue $500,000 in bonds to be used in connection with the Pacoima Canyon Flood Control project will be submitted to the voters.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company has applied to the State Railroad Commission for authority to issue $5,000,000 in capital stock, to be sold at not less than $85 per share, the proceeds to be used for new construction work.

SAN FRANCISCO, CAL.—A petition has been submitted to the Board of Supervisors by the Point Lobos Improvement Club to place all wires underground on Clement Street from First to Funston Avenue and to remove all poles from the street.

SAN JOSE, CAL.—The construction of a new power house and cold-storage plant at the County Hospital is under consideration by the Board of Supervisors of Santa Clara County, San Jose.

MOUNTAIN HOME, IDAHO. — The Elmore Copper Company contemplates the construction of a dam and hydro-electric power plant on the south fork of the Boise River, about 25 miles north of the Arrowhead dam. The cost is estimated at more than $100,000.

SANTA FE, N. M.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Feb. 1 for installing lighting fixtures in the United States public building at Santa Fé, N. M.

SALT LAKE CITY, UTAH.—The Dixie Power Company has filed application on 15 sec.ft. of water from Coal Creek in Iron County, to develop 930 hp. The company is also considering increasing the capacity of the old plant and changing its system from three-phase to single-phase.

SALT LAKE CITY, UTAH.—The town of Junction has filed application at the office of the State Engineer for the use of 5 sec.ft. of water from City Creek in Piute County to be used in development of municipal power for the towns of Circleville and Junction. The plans provide for a total development of 530 hp. It is proposed to use the water twice, the first power development for distribution in Junction and Circleville and a second power development for use in the northern part of Piute County and the southern part of Sevier.

Canada

CAYUGA, ONT. — The City Council is considering plans for the installation of an electric light and distribution system in Cayuga. R. S. Colter is a member of the Council.

HENSALL, ONT.—The installation of an electric light and power distribution system in Usborne Township is under consideration. H. Strang is a member of the Council.

MEAFORD, ONT.—The question of submitting to the ratepayers a bylaw authorizing the extension of hydro-electric lines to Meaford is under consideration.